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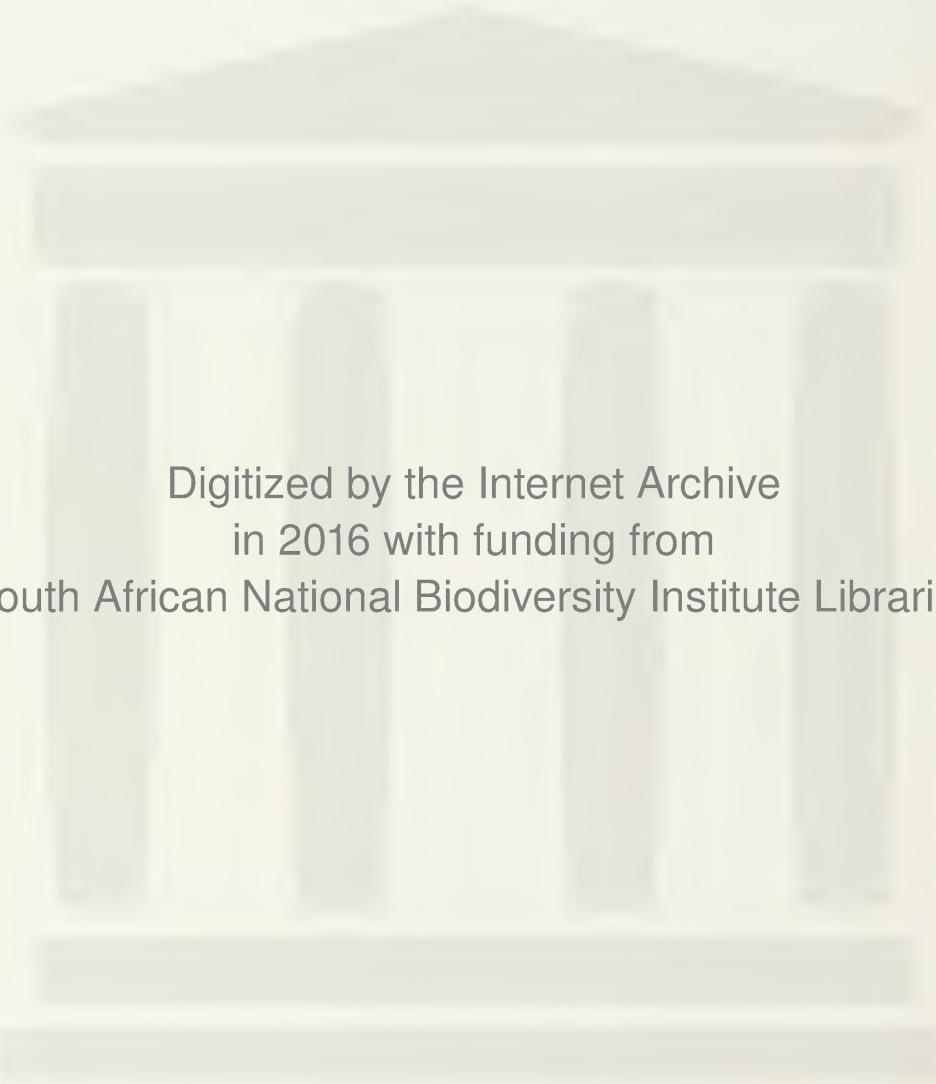
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1975

VELD TYPES  
of  
SOUTH AFRICA

J.P.H. ACOCKS

BOTANICAL RESEARCH INSTITUTE • DEPARTMENT OF AGRICULTURAL TECHNICAL SERVICES • REPUBLIC OF SOUTH AFRICA  
NAVORSINGSINSTITUUT VIR PLANTKUNDE • DEPARTEMENT LANDBOU-TEGNIESE DIENSTE • REPUBLIEK VAN SUID-AFRIKA



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MEMOIRS OF THE BOTANICAL SURVEY OF SOUTH AFRICA No. 40  
MEMOIRS VAN DIE BOTANIESE OPNAME VAN SUID-AFRIKA No. 40

# VELD TYPES

## SOUTH AFRICA

WITH ACCOMPANYING VELD TYPE MAP

by

MARY GUNN LIBRARY  
NATIONAL BOTANICAL INSTITUTE  
PRIVATE BAG X 101  
PRETORIA 0001  
REPUBLIC OF SOUTH AFRICA

J. P. H. ACOCKS

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SOUTH AFRICA—SUID-AFRIKA

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## *Foreword to first edition*

The "Veld Types of South Africa" by John P. H. Acocks has been eagerly awaited by workers in many fields of study. It is now nearly 20 years since Dr I. B. Pole Evans prepared his coloured vegetation map of the Union for Botanical Survey Memoir No. 15. Since then a great deal has been added to our knowledge of the distribution and classification of our flora. Road communications have vastly improved which has made it possible for Mr Acocks to cover the large area of the Union very thoroughly. However, he has not yet been able to survey all the different veld types in equal detail and is continuing with his programme.

From his student days Mr Acocks has been an ardent plant geographer. In 1935 he joined the Department of Agriculture as an ecologist, and in the course of his studies has travelled and collected extensively over most parts of the Union. As a plant collector he is a second E. E. Galpin. He has amassed a vast amount of data, of which the present work is a mere summary. It is, nevertheless, in sufficient detail to meet the main requirements of anyone interested in the composition and distribution of veld types in the Union, be he farmer, agriculturist or professor of botany. It will be especially valuable to officers of the Department of Agriculture in their aim to correlate farming practice with vegetation cover. Mr Acocks endorses the grave warning so often heard in these times that unless the Department does succeed in this vital matter of soil and veld conservation the country faces ruin by the general advance of desert conditions.

It has been mentioned that the present account is a summary of what has been recorded so far. Owing to the many urgent needs which the vegetation map will meet it was decided to proceed with its publication with as little delay as possible. Thus any shortcomings due to unequal treatment and curtailment of text must not be attributed to the author.

The original of the large coloured Veld Type map was prepared by Mr Acocks—himself an artist—but this does not lessen our gratitude to the Department of Trigonometrical Survey and to the Government Printer for the excellence of the reproduction. It is both an accurate guide and a work of art.

R. A. DYER

Chief, Division of Botany

and

Director of Botanical Survey of the

Union of South Africa

Pretoria

27th June 1952

## *Foreword to second edition*

No other work dealing with the vegetation of South Africa has had a more profound effect on the ecological scene in this country than Acocks's "Veld Types of South Africa". Ever since it first appeared in 1953 it has been a standard handbook for students, agriculturalists and ecologists. It not only proved to be of academic importance, but has been widely used in agricultural planning by the Department of Agricultural Technical Services. In some ways it is an almost unique publication and few other countries have a comparable work dealing with a broad survey of all its plant communities.

The first edition is now out of print and the decision had to be made whether to reprint the work as it is, or whether to wait for the completely revised edition which is being prepared by the author but which will not be ready for the press for several years. The new edition presented here is a compromise. The text has not been revised, except for the plant names which have been checked and brought up to date. The main difference between the two editions lies in the inclusion of illustrations in the new edition. It is felt that the photographs mostly taken by Mr Acocks, which illustrate practically all of the major veld types, greatly enhance the value of this work and offset to some extent the lack of revision of the text which may be a source of disappointment to some readers. The accompanying map has been reprinted unaltered and is available with the text to the new edition.

The work of revising and augmenting the text for a third edition continues and we trust that it will be completed within a few years. In the interim, the second edition of "Veld Types" will serve a real need.

B. DE WINTER

Director: Botanical Research Institute

Pretoria

17th September 1974



# Contents

	<i>Page</i>
CHAPTER 1 INTRODUCTION . . . . .	1
Variability of vegetation . . . . .	1
Definition of the term "veld type" . . . . .	1
Origins of veld types and their interrelationships . . . . .	1
Migration routes . . . . .	3
CHAPTER 2 INSTABILITY OF VEGETATION . . . . .	5
CHAPTER 3 RECENT AND FUTURE CHANGES IN VEGETATION . . . . .	7
Map No. 1 . . . . .	7
Map No. 2 . . . . .	7
Map No. 3 . . . . .	9
Map No. 4 . . . . .	9
Map No. 5 . . . . .	10
CHAPTER 4 DESCRIPTION OF THE VELD TYPES . . . . .	11
I COASTAL TROPICAL FOREST TYPES	
1 COASTAL FOREST AND THORNVELD	
(a) The Typical Coast-belt Forest	
Forest . . . . .	13
Thornveld . . . . .	14
(b) The Zululand Palm-veld	
Forest . . . . .	15
Thornveld . . . . .	16
(c) The Transitional Forest . . . . .	16
(d) The Dune-forest	
Forest . . . . .	16
Thornveld . . . . .	17
(e) The Mangrove Forest . . . . .	17
2 THE ALEXANDRIA FOREST	
Forest . . . . .	17
Thornveld . . . . .	19
3 THE PONDOLAND COASTAL PLATEAU SOURVELD	
Forest . . . . .	19
Sourveld . . . . .	20
4 THE KNYSNA FOREST . . . . .	20
5 THE 'NGONGONI VELD	
Forest . . . . .	21
Thornveld . . . . .	23
6 THE ZULULAND THORNVELD	
(a) The Low Altitude Form	
Forest . . . . .	23
Bushveld . . . . .	24
(b) The High Altitude Form	
Forest . . . . .	24
Sourveld . . . . .	24
7 THE EASTERN PROVINCE THORNVELD	
(a) The Northern Form . . . . .	24
(b) The Southern Form . . . . .	24
II INLAND TROPICAL FOREST TYPES	
8 NORTH-EASTERN MOUNTAIN SOURVELD	
Forest . . . . .	25
Sourveld . . . . .	26
9 LOWVELD SOUR BUSHVELD	
Bush . . . . .	27
Grass . . . . .	27

**III TROPICAL BUSH AND SAVANNA TYPES (BUSHVELD)**

10 LOWVELD		28
Bush . . . . .		29
Grass . . . . .		29
11 ARID LOWVELD		30
Typical Form . . . . .		30
Dense Bush of Valleys . . . . .		30
12 SPRINGBOK FLATS TURF THORNVELD		
(a) Red Turfveld . . . . .		31
(b) Black Turfveld . . . . .		31
13 OTHER TURF THORNVELD		
(a) On Limestone . . . . .		32
(b) Norite Black Turfveld . . . . .		32
(c) <i>Acacia</i> Veld . . . . .		32
(d) Knoppiesdoring Veld . . . . .		33
14 ARID SWEET BUSHVELD		
(a) Dwarf <i>Terminalia</i> - <i>Rhigozum</i> Veld . . . . .		34
(b) <i>Grewia flava</i> Veld . . . . .		34
(c) Dwarf <i>Combretum apiculatum</i> Veld . . . . .		35
(d) <i>Commiphora pyracanthoides</i> Veld . . . . .		35
(e) <i>Adansonia</i> Mixed Thornveld . . . . .		35
(f) <i>Panicum maximum</i> - <i>Acacia karroo</i> Veld . . . . .		36
(g) <i>Dichrostachys</i> - <i>Acacia</i> Veld . . . . .		36
15 MOPANI VELD . . . . .		37
16 KALAHARI THORNVELD		
(a) Kalahari Thornveld Proper		
(1) North-eastern . . . . .		39
(2) Eastern . . . . .		39
(3) Central . . . . .		39
(4) Western and North-western . . . . .		40
(b) Vryburg Shrub Bushveld		
(1) <i>Tarchonanthus</i> Veld of the Kaap Plateau		
(i) Dense <i>Tarchonanthus</i> Veld on Limestone . . . . .		41
(ii) Open <i>Tarchonanthus</i> - <i>Rhus ciliata</i> Veld on Dolomite . . . . .		42
(iii) Dense Mixed Shrub Bushveld of the Escarpment . . . . .		42
(2) Mixed <i>Tarchonanthus</i> Veld of the Asbestos and Kuruman Hills . . . . .		42
(3) Mixed <i>Tarchonanthus</i> - <i>Rhus</i> - <i>Croton</i> Veld of the Langeberg . . . . .		42
(4) Mixed <i>Tarchonanthus</i> -Thorn Veld of the Kimberley Plains and Koppies . . . . .		43
17 KALAHARI THORNVELD INVADED BY KAROO . . . . .		43
18 MIXED BUSHVELD		
(1) <i>Combretum apiculatum</i> Veld		
(a) <i>Combretum apiculatum</i> Veld Proper . . . . .		44
(b) <i>Combretum apiculatum</i> - <i>Pterocarpus rotundifolius</i> Veld . . . . .		44
(2) Mixed <i>Terminalia</i> - <i>Dichapetalum</i> Veld		
(a) <i>Terminalia</i> Veld Proper . . . . .		44
(b) <i>Combretum</i> - <i>Terminalia</i> Veld . . . . .		45
(c) <i>Sclerocarya</i> - <i>Burkea</i> Veld . . . . .		45
(d) <i>Burkea</i> Veld . . . . .		46
(e) <i>Acacia nigrescens</i> - <i>Combretum apiculatum</i> - <i>Kirkia wilmsii</i> Veld . . . . .		46
(f) Open <i>Sclerocarya</i> Veld . . . . .		47
(g) <i>Dombeya rotundifolia</i> - <i>Acacia rehmanniana</i> Veld . . . . .		48
19 SOURISH MIXED BUSHVELD . . . . .		48
20 SOUR BUSHVELD . . . . .		49
<b>III A FALSE BUSHVELD TYPES</b>		
21 FALSE THORNVELD OF EASTERN CAPE . . . . .		50
22 INVASION OF GRASSVELD BY THORN . . . . .		51

## IV KAROO AND KARROID TYPES

23 THE VALLEY BUSHVELD	
(a) Valley Bushveld Proper, Northern Variation	52
(b) Valley Bushveld Proper, Southern Variation	53
(c) Fish River Scrub	54
(d) (i) The Addo Bush	56
(ii) Sundays River Scrub	56
(e) Gouritz River Scrub	57
24 THE NOORSEVELD	58
25 THE SUCCULENT MOUNTAIN SCRUB (SPEKBOOMVELD)	58
26 THE KARROID BROKEN VELD	
(a) The Great Karoo	60
(b) The Little Karoo	61
(c) The Grassy Mountain Scrub	63
27 THE CENTRAL UPPER KAROO	63
28 THE WESTERN MOUNTAIN KAROO	
(a) The Upper Form	64
(b) The Lower Form	65
29 THE ARID KAROO	
(a) Blomkoolganna Veld	66
(b) Driedoring Veld	67
(c) The Semi-succulent Southern Form	68
30 THE CENTRAL LOWER KAROO	69
31 THE SUCCULENT KAROO	
(a) The Namaqualand Coast-belt	69
(b) The Tanqua Karoo	70
(c) The Steytlerville Karoo	71
32 THE ORANGE RIVER BROKEN VELD	
(a) The Typical Form	72
(b) The <i>Rhigozum trichotomum</i> Veld	73
(c) The <i>Acacia mellifera</i> subsp. <i>detinens</i> Veld	73
33 THE NAMAQUALAND BROKEN VELD	
(a) The Typical Form	74
(b) The <i>Rhigozum trichotomum</i> Veld	75
(c) The False Desert Grassveld	75
34 THE STRANDVELD	
(a) Dense Scrub	75
(b) Strandveld Proper	75
IVA FALSE KAROO TYPES	
35 THE FALSE ARID KAROO	76
36 THE FALSE UPPER KAROO	78
37 THE FALSE KARROID BROKEN VELD	79
38 THE FALSE CENTRAL LOWER KAROO	79
39 THE FALSE SUCCULENT KAROO	79
40 THE FALSE ORANGE RIVER BROKEN VELD	80
41 PAN TURF VELD INVADED BY KAROO	80
42 KARROID MERXMUELLERA MOUNTAIN VELD REPLACED BY KAROO	81
43 MOUNTAIN RHENOSTERBOSVELD	81
V TEMPERATE AND TRANSITIONAL FOREST AND SCRUB TYPES	
44 (a) HIGHLAND SOURVELD	
Forest	82
Sourveld.	83
(b) DOHNE SOURVELD	
Forest	84
Sourveld	84

	Page
45 NATAL MIST BELT 'NGONGONI VELD	
Forest . . . . .	85
Sourveld . . . . .	86
46 COASTAL RHENOSTERBOSVELD	
Scrub Relics . . . . .	86
Rhenosterbosveld . . . . .	86
47 COASTAL MACCHIA . . . . .	87
<b>VI PURE GRASSVELD TYPES</b>	
48 THE CYMBOPOGON–THEMEDA VELD	
(a) The Southern Variation . . . . .	88
(b) The Northern Variation . . . . .	88
49 THE TRANSITIONAL CYMBOPOGON–THEMEDA VELD	
Grassveld . . . . .	89
Hillside Scrub . . . . .	90
50 THE DRY CYMBOPOGON–THEMEDA VELD	
(a) The Northern Variation . . . . .	90
(b) The Central Variation . . . . .	90
(c) The Southern Variation . . . . .	91
(d) The South-eastern Variation . . . . .	92
51 THE PAN TURF VELD . . . . .	92
52 THE THEMEDA VELD OR TURF HIGHVELD . . . . .	92
53 PATCHY HIGHVELD TO CYMPOBOGON–THEMEDA VELD TRANSITION . . . . .	92
54 TURF HIGHVELD TO HIGHLAND SOURVELD VELD TRANSITION . . . . .	94
55 BANKENVELD TO TURF HIGHVELD TRANSITION . . . . .	94
56 HIGHLAND SOURVELD TO CYMBOPOGON–THEMEDA VELD TRANSITION	
Grassveld . . . . .	94
Hillside Scrub . . . . .	95
57 NORTH-EASTERN SANDY HIGHVELD	
(a) Near-Bankenveld . . . . .	95
(b) Near-Highland Sourveld . . . . .	95
58 THEMEDA–FESTUCA ALPINE VELD . . . . .	95
59 STORMBERG PLATEAU SWEETVELD . . . . .	97
60 KARROID MERXMUELLERA MOUNTAIN VELD . . . . .	98
<b>VIA FALSE GRASSVELD TYPES</b>	
61 BANKENVELD	
(a) The Western Variation . . . . .	99
(b) The Central Variation . . . . .	99
(c) The Eastern Variation . . . . .	100
62 BANKENVELD TO SOUR SANDVELD TRANSITION . . . . .	100
63 PIET RETIEF SOURVELD	
Scrub Forest . . . . .	100
Grassveld . . . . .	101
64 THE NORTHERN TALL GRASSVELD . . . . .	101
65 THE SOUTHERN TALL GRASSVELD	
Open Thornveld . . . . .	102
Scrub Forest . . . . .	103
66 NATAL SOUR SANDVELD . . . . .	103
67 PIETERSBURG PLATEAU FALSE GRASSVELD . . . . .	104
68 EASTERN PROVINCE GRASSVELD . . . . .	104
<b>VII SCLEROPHYLLOUS BUSH TYPES</b>	
69 MACCHIA . . . . .	104
<b>VIIA FALSE SCLEROPHYLLOUS BUSH TYPES</b>	
70 FALSE MACCHIA . . . . .	106
ACKNOWLEDGEMENTS . . . . .	109
REFERENCES . . . . .	109
ADDENDUM: CHANGES TO MAP . . . . .	111
INDEX TO SPECIES AND GENERA . . . . .	113

# Introduction

Earlier vegetation maps of the Republic, those of Pole Evans (1935), Adamson (1938) and Penty (1947), are on the broadest lines, recognizing only 19, 14 and 21 vegetation types respectively. In 1945 the present survey was initiated and, for general utility, it was decided to draw the vegetation boundaries on the existing 1:1 500 000 Postal Communications Map. It has to be admitted that the basic map contains certain inaccuracies, particularly as regards the positions of country post offices. Thus in using the Veld Type Map, this must be borne in mind in cases where a post office appears to be situated in the wrong veld type. The western half of the Republic is mapped in less detail than the eastern half; so is the north-western Transvaal and Lesotho. The north-western Transvaal was mapped by Irvine (1941), accompanied in the later stages by the present writer, and Irvine's map has been taken over with minor modifications.

The collation of field-notes and other available information is not yet complete, nor has it been possible to study all the relevant literature. This account, therefore, is a preliminary description of the map, and is an outline of the botanical and related agro-ecological problems and theories which it is hoped to discuss in detail at a later date.

## VARIABILITY OF VEGETATION

Even though this new map recognizes 70 veld types, plus 75 variations, the fact remains that it, too, is on broad lines. Every farmer knows that variations in the veld, even over short distances, are legion. These small variations are of great importance in farm management and, in the course of time, should be mapped farm by farm. Every farmer who knows his job allows for them, but a large part of the erosion damage throughout the country is the result of not allowing for them. This subject will be elaborated below.

To give an idea of how great this variation in the veld may be, a section of a detailed map of a 600 hectare farm, namely, Toowoomba Research Station near Warmbaths in the Transvaal, is included in this memoir (Diagram 1). Besides natural variations resulting from variations in soil, some so subtle that a soil survey failed to reveal them, this map shows the variations that can result from varying grazing treatment. Not all the vegetation of the Republic is as variable as this sample of Bushveld, yet even an apparently uniform veld type like Karoo shows the most surprising variation when one examines it closely. It should be remembered that sheep and cattle examine it more closely than anyone.

Vegetation changes according to the way it is treated. This is the essential fact that must be grasped if one is to understand the vegetation of a recently settled country like South Africa. There is little or no vegetation in South Africa which is in its original condition, and this has not been made sufficiently clear in previous accounts of our vegetation. The scantiness of records of vegetation as it was when Europeans settled the country, makes it difficult to define the changes which have since occurred, enormous though some of them undoubtedly are. Fortunately, the changes are not yet complete. Notes made by the writer 14 years ago in the Kimberley area show that Karoo has in the interval largely replaced the grassveld constituent of the Thornveld; and the Karoo has nearly overrun the Dry *Cymbopogon-Themeda* Veld in the southern Free State and north-eastern Cape.

## DEFINITION OF THE TERM VELD TYPE

Before going further, the term "Veld Type", as used in this memoir, must be defined. Vegetation is made up of individual plants, few or many, according to the habitat, belonging usually to a number of different species; they live together, competing with each other and perhaps assisting one other, so that a balance is maintained at a level of development determined by the locality or environment. From a consideration both of botanical composition and of practical utilization, one arrives at the concept of the Veld Type—a unit of vegetation whose range of variation is small enough to permit the whole of it to have the same farming potentialities. The environment includes many variable factors, such as grazing animals, birds and insects, light, heat and, most important of all, water. With variations in environment one gets variations in the vegetation and the problem is to group the infinite variations of the vegetation into manageable units, and to separate the natural variations from the man-made ones. Seeing that the vegetation of the Republic is made up of 15 000 to 16 000 species of flowering plants, the possibilities of variation are endless. But all the species do not occur all over the country; in fact, not a single one does, and the great majority are scarce and localized, and for practical purposes one has to deal with about 2 000 more or less important species. Some of them are widely distributed over a number of obviously different vegetation types, while others are strictly confined to one type of vegetation. It is possible to select relatively few species which will serve as indicators of different kinds of vegetation and of changes in vegetation, whatever the unit decided on.

Such a concept of Veld Type as adopted can allow quite a wide botanical variation, e.g. in the case of the Mixed Bushveld or the Arid Karoo; but the Veld Type being a vegetation unit, this variation is limited to variation in the relative importance of members of a group of species occurring all through its area. When the species change, a new Veld Type must be established. Thus the Arid Lowveld-Bushveld, although it is Mixed Bushveld, has been separated from the Mixed Bushveld of the north-western Transvaal because its species composition differs.

## ORIGINS OF VELD TYPES AND THEIR INTER-RELATIONSHIPS

An interesting aspect of the mapping of the veld types is the disentangling of their origins and inter-relationships; firstly, because vegetation is always trying to migrate into drier habitats by virtue of the process of succession, so that any movement (such as we find in South Africa) of a vegetation type into a wetter habitat is of particular interest and importance; and secondly, because in South Africa we have two entirely distinct floras, viz. the Southern Fynbos (or Sclerophyll) and forest of the winter rainfall area, and the tropical forest, savanna and grassveld of the summer rainfall area. Although entirely different in nature and origin, they are to-day almost inextricably mixed, and have co-operated to produce that quite distinct vegetation type, the Karoo with all its variations. It is clear enough that the tropical vegetation has in the past migrated southwards and westwards along the wetter eastern side of

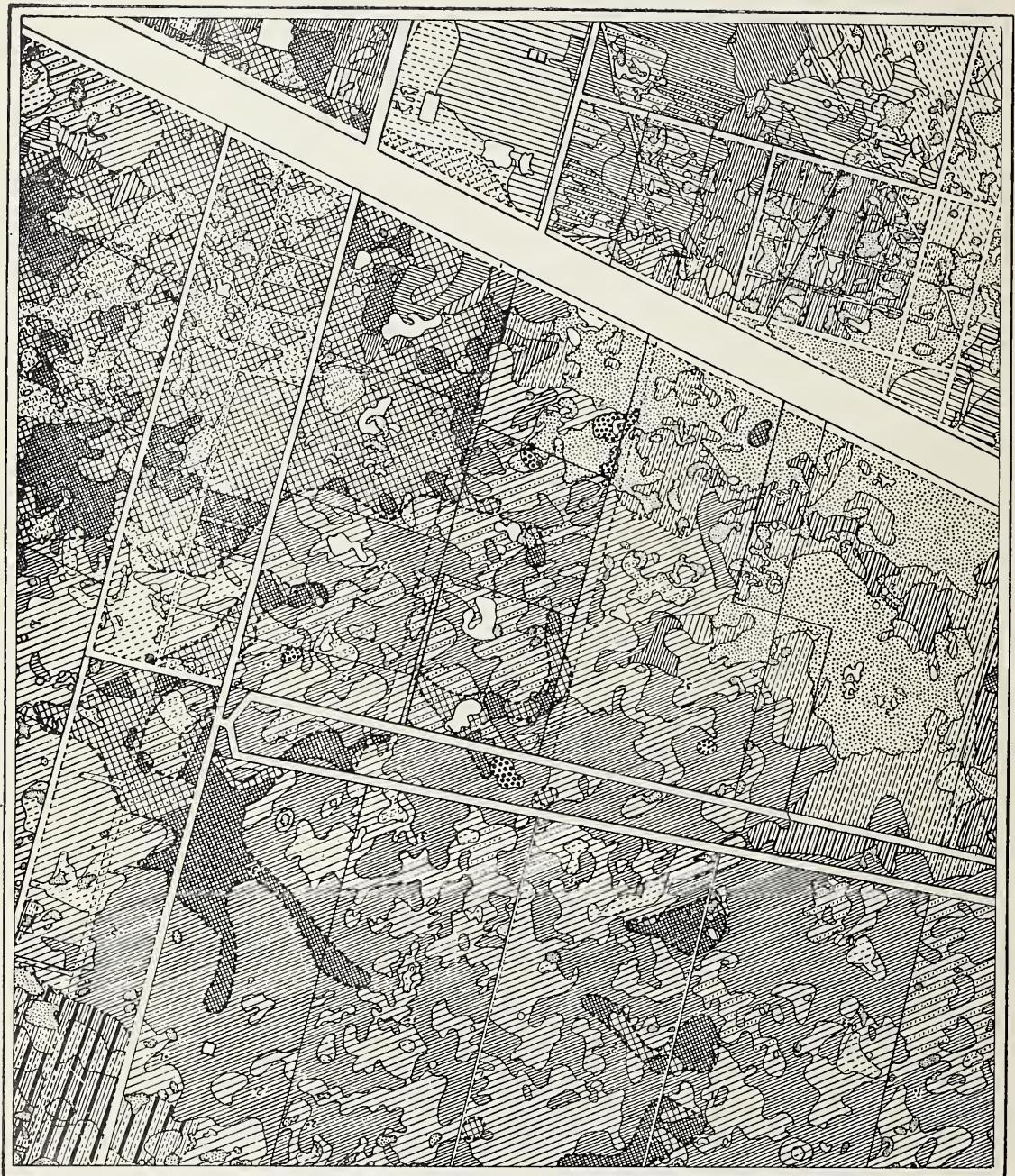


Diagram I.—Vegetation Chart of a Portion of Toowoomba Research Station near Warmbaths, Transvaal.

the country and to some extent into the drier western parts: it is equally clear that to-day the Fynbos and Karoo are moving eastwards and northwards at a phenomenal speed into the territory of the tropical vegetation, and that the advancing Karoo is leaving behind it a desert "vacuum".

Both these kinds of vegetation are considered to be very old, and to have been well established long before the grasses were evolved. Grasses are so indispensable to-day in covering and holding the soil, that it is difficult to understand the continuance, in a mountainous condition, of an old land surface without them. In the Fynbos, however, we have a vegetation-type which is capable of covering the soil fairly adequately without the help of grasses, which the tropical vegetation cannot do in areas unsuitable for the development of closed scrub or forest. It is reasonable to suppose, therefore, that, in the days before there were grasses (and quite apart from possible climatic differences), some form of Fynbos had a much wider distribution in areas which are to-day Tropical Grassveld and Savanna; and that it was pushed back by the sward-forming tropical grasses, when they appeared, into its strongholds in the winter-rainfall areas, and areas on mountain ranges and along coastlines where winter moisture is available and conditions are less suited to the tropical grasses. The picture is obscured by the surging backwards and forwards of vegetation types in response to less ancient changes of climate which we know to have more than once occurred. The relics of Fynbos in tropical vegetation, therefore, may have more than one origin, though the presence of *Erica* in Europe and of *Podocarpus* and *Protea* in Central Africa is likely to be an indicator of the ancient distribution of Fynbos. It must here be pointed out that these climatic changes probably occurred over periods of tens of thousands, or hundreds of thousands of years, and not over periods of a century or less, like the change in vegetation we are witnessing to-day. Further, although there is some evidence (Brooks, 1926) that there are also minor fluctuations of climate with a periodicity of about 200 years, these cannot be invoked to explain the changes that are going on to-day, because these changes are too great to be reversible in the space of 100 years without leaving far more records than actually exist.

The origin of the Karoo flora is of particular interest. Bews (1925) supposed it to be derived from the Bushveld via the Fish River Scrub. That seems likely enough for the Great Karoo and Little Karoo, where most of the large shrubs are actual Bushveld species and many of the succulents are either Bushveld species or closely related, but not all the Karoo flora can be so derived. The succulent habit is not peculiar to any one vegetation type, but is rather a reaction to habitat, in particular to a permanent scarcity of moisture. Succulents are represented in all the veld types of South Africa. Those of the Karoo, therefore, can be derived from both the southern and the tropical floras. An interesting point is that our solitary representative of the Cactaceae (*Rhipsalis*) is a forest species. The other important constituent of the Karoo, the non-succulent shrublet or Karoo-bush, has become relatively scarce in much of the Little Karoo and Great Karoo, but is still dominant in the Upper Karoo and the False Karoo types; the origin of this plant-form is not to be sought in the tropical flora, where it scarcely occurs, but in the Fynbos. Common genera in the Karoo like *Chrysocoma*, *Hermannia*, *Euryops*, *Pteronia*, *Eriophyllum*, *Selago*, *Walafrida* and *Lichtfootia* are all well represented in the Fynbos; *Pentzia* and *Phymaspernum*, too, in some forms of Fynbos; and

there is a very good transition from Fynbos and Arid Fynbos through Mountain Rhenosterveld and the Western Mountain Karoo to the ordinary short kind of Karoo, both in species-composition and growth-form. There is no such transition from Karoo to the arid types of Bushveld, the Karoo simply petering out in this direction. This is well seen in the southern part of South West Africa, where, on the other hand, the contribution of Acanthaceae, Euphorbiaceae and Amaranthaceae to the Karoo flora by the tropical flora is clearly seen, as is the contribution of shrubs and trees to the north-western forms of Karroid Broken Veld. To-day there appears to be a transition to the Bushveld in the south-east, because the Karoo has invaded the Noorsveld and Fish River Scrub, with *Pentzia incana* playing an important part; but there are indications that, in the natural state of affairs, there would be a grass savanna and bush clump veld separating the Noorsveld, etc., from the Karoo. In this event the under-growth in the Noorsveld would have been grasses of tropical origin, e.g. *Themeda*, *Setaria*, *Panicum*, *Eragrostis*, *Enneapogon* and *Aristida*, all of which are still to be found in protected places, and they form a dense grassveld, dotted with small trees and a few large Karoo bushes, in protected parts of the surrounding Karroid Broken Veld.

It would seem, therefore, that the Karoo has a strong Fynbos affinity, especially the Upper Karoo and the Western Mountain Karoo; and that when Man disturbs the tropical grassveld and scrub, and induces a Karoo invasion, it is these Fynbos-derived elements of the Karoo which play the leading part. That is to say, the changes in vegetation which are occurring to-day are an artificial reversal of the evolutionary replacement of the southern scrub vegetation by a sward of grass of tropical origin. That is in broad terms, of course; there are minor changes too, the most important of which is the replacement of Tropical Grassveld by Bushveld via Thornveld, with the Karoo ever moving forward. The view is taken that the ecology of South Africa is something dynamic.

## MIGRATION ROUTES

A study of all available information on plant distribution, taken in conjunction with the topography and rainfall distribution of Southern Africa, will show the main plant migration routes to be:—

### *A From the north*

(1) Along the east coast, i.e. on the seaward side of the Drakensberg and other mountains southwards. In the drier parts northwards and southwards the mountains themselves become important for more mesophytic species. (Examples of this type of migration are: *Scutia myrtina*, *Eulalia villosa* and *Ptaeroxylon obliquum*.)

(2) The tops of the Drakensberg and other mountains and the Highveld; cold, rather flat country. (e.g. *Myrsine africana*, *Setaria flabellata*, *Euphorbia clavarioides* and *E. pulvinata*.)

(3) The hot, but fairly wet, river valleys down the east coast and inland, e.g. Tugela, Umzimvubu, Bashee, Kei, Keiskama, Great Fish, Sundays, Gamtoos and Gouritz valleys down the east coast; Limpopo, Harts, Lower Vaal and Orange valleys inland. (e.g. *Panicum maximum* and *Maytenus heterophylla*.)

(4) The Kalahari; flat, hot, semi-arid to arid sandy country. (e.g. *Acacia erioloba*, *Oropetium capense* and *Anthephora pubescens*.)

(5) South West Africa; hot, rocky, partly mountainous country, ranging from semi-arid in the north to very arid in the south. (e.g. *Aloe dichotoma*, *Parkinsonia africana* and *Phaeoptilum spinosum*.)

(6) The west coast, inhospitable desert. (e.g. *Eragrostis spinosa* and *Zygophyllum morgsana*.)

(7) North-east Cape and southern Free State: mountainous and fairly wet country at a moderate elevation, linking the east coast route with the Inland Valley route. (e.g. *Aloe ferox*, *Olea africana* and *Rhynchelytrum repens*.)

#### B From the south

(8) Along the south coastal mountain ranges and thence along the Drakensberg; wet country. (e.g. *Passerina* spp. and *Merxmuellera stricta Erica caffra*.)

(9) Along the west coastal mountain ranges; wet in the south, dry in the north. (e.g. *Montinia caryophyllacea*, *Lobostemon argenteus* and *Diosma eckloniana*.)

(10) Along the south and east coast. (e.g. *Karroo-chloa curva*, *Passerina rigida* and *Agathosma* spp.)

(11) Along the mountain ranges of the Karoo region and thence along the Drakensberg. (e.g. *Merxmuellera disticha* and *Passerina montana*.)

It is clear that sea coasts, continuous mountain ranges and broken country (whether it consist of mountains rising out of a plain, or of deep valleys sunk into a plain), form particularly favourable migration routes for a wide variety of plants. The sea coasts are under the moderating influence of the sea and are more or less frost-free in our latitudes, even though they may be arid; the mountains usually receive a better rainfall than the plains, while the valleys, although tending to be drier, are usually warmer than either the plains or the mountains. The mountains and valleys provide a wide variety of climatic conditions: warm, dry northern and western aspects; cool damp southern and eastern aspects: frost-free areas resulting from peculiarities of air drainage; areas sheltered from the severity of winds; areas on the summits with a cold, severe climate or, on the other hand, benefiting by receiving winter-moisture, in the form of snow, during the dry season of the surrounding country; and so forth. They provide protection against widespread fires and are less accessible to grazing animals, in parts even inaccessible. Further, during major climatic fluctuations, these routes remain open far longer than does flat country, which provides no harbours of refuge for the many plants that have little power of adapting themselves to changing conditions. They have been used in the past, and they are being used again to-day, notably by the southern flora in its advance and the tropical in its retreat. Along the south coast, the Fynbos is using both the mountains and the plains, where conditions are not fully favourable to the tropical flora, for its advance; in the inland parts, on the Upper Plateau, Fynbos (in the form of *Elytropappus-Chrysocoma-Euryops-Merxmuellera* Veld) is similarly ousting the tropical flora from the mountain tops; but, on the other hand, the tropical grassveld is holding on to the slopes and rocky hills, especially on southern aspects, very successfully against the Karoo, even though it has been driven back hundreds of kilometres in the plains by the Karoo. In the Eastern Cape, in the dry parts, the Karroid (or Succulent) Bushveld holds on to the hills, but gives way to the Karoo on the plains, e.g. in the Great Fish valley; while in the wetter parts the tropical grassveld of the plains is unable to resist either the spread of the more arid tropical type, thornveld, or the spread of the Karoo, e.g. in the upper Swart Kei basin or in the Bedford and Somerset East Divisions.

It is on the plains of the Eastern Cape, Orange Free State, Griqualand West and the Western Transvaal that the most startling vegetation changes are to be expected in the near future, as the tropical grass veld retreats before a double invasion by thorn and Karoo.

As regards migrations in the past, the biggest that there is evidence for are (1) an ancient migration of the southern flora northwards to Ethiopia and even Europe and to Angola, and (2) that of the tropical flora southwards, which has continued until now. Relics of the southern flora crop up all along the mountains on the eastern side of Africa and in Angola; and, within the Republic, all over the country between the mountains and the east coast and as far inland as the Waterberg and Magaliesberg; they have not yet been found on the Langeberg in Hay and Kuruman divisions, but the vegetation of the top of this range is so much like Fynbos in form that the writer is confident that relics will be found there. This range has certainly enabled some of the tropical grasses and trees to penetrate far into otherwise unsuitable country. The wide dispersal of *Felicia muricata* and of certain *Euryops* spp. *Delosperma* spp., *Stapelia* spp. and bulbous plants, suggests a former wider spread of the Karoo or some form of arid Fynbos; which links up with the present distribution of such species as *Portulacaria afra*, suggesting that these migrated down the east coast at a time when conditions were a good deal drier than they are now. On the other hand, the distribution of such species as *Nymmania capensis* suggests that their migration from the north-west occurred at a time when conditions were warmer, if not wetter. The same applies to such species as *Azima tetracantha* which had to cross the Karoo plateau to reach the Kaap Plateau, but does not survive there to-day; or to *Rauvolfia caffra*, which occurs in sheltered kloofs on the northern side of the Magaliesberg and has no possible migration route from the coast under present conditions.

For as long as the ocean currents, winds and mountains have been as they are to-day, the general pattern of the climate will have been the same; this means that the east side of the country will have been a favourable migration route and the west side an unfavourable migration route, for the same length of time. Thus, although elements of the southern flora (*Protea*, *Stoebe*, *Philippia*, *Lightfootia*, *Thamnosma*) succeeded in reaching Angola, of the tropical flora only specialized desert plants (*Tamarix*, *Bauhinia*, *Adenium*, *Rhigozum*, *Commiphora*) have reached the Republic by this route; and although many of the tropical species which have penetrated far to the south and west along the east coast route (including *Azima*, mentioned above) also occur in Angola, there is no sign that they ever migrated down the west coast or through the Kalahari. Exceptions are very few; *Sarcostemma viminale* appears to be one. Nor is there any sign that the Karoo ever reached Angola, or that it originated there or in that direction. These considerations might be taken to indicate, also, that the southern flora is older than the tropical flora, that at the time of this wider distribution of the southern flora, the Karoo had not been evolved; and that since that time there has been no conspicuously wet period, though there may have been exceptionally dry periods.

The vegetation we know to-day is primarily the result of all these migrations during millions of years, secondarily the result of the activities of the Bantu and European during the last three hundred years, and, in particular, the last one hundred years.

## Instability of vegetation

It must be realized that much of the erosion damage in the country is the result of not allowing for the small variations in the veld in grazing management. These small variations are mainly caused by soil differences: e.g. an accumulation of silty soil in a depression, however small, or along a valley, will have a somewhat different vegetation from the surrounding veld, usually more palatable and tending to remain green longer, because it gets more water; or the richer soil in the shade of a group of trees will have a softer, sweeter vegetation; or the heavier soil around an anthill will carry a more palatable vegetation than the open veld. The consequence is that grazing animals, particularly sheep, tend to concentrate in such areas, causing undue grazing pressure, denuding the soil and making conditions suitable for a concentration of water through increasing run-off. This may be termed "zonal selective grazing". It is particularly noticeable in mixed veld, e.g. the Mixed Bushveld of Warmbaths or the Dry *Cymbopogon-Themedea* Veld of the Orange Free State.

The same phenomenon, in an aggravated form, has resulted from the old practice of driving livestock long distances to water and kraaling them for the night. When natural surface waters (rivers and springs) were the only sources of drinking water and carnivores were a menace to stock, there was no help for this practice. The result was a denuded zone along rivers and around springs, especially in the more arid parts of the country where the vegetation has little resistance to over-grazing and trampling and recovers slowly. In these parts it is still often unnecessary to consult a map to find out if one is approaching a big river—a desert-like condition is a good indicator. Denuded veld is seen on town commonages, at some mission stations and around irrigation settlements; but on many farms the phenomenon is disappearing as a result of fencing, provision of water from bore-holes in each camp and the elimination of the kraaling system. Selective grazing is actually the most urgent problem in grazing management, and although the pasture research stations have devoted much attention to it, there seems to be little general realization of its importance. Its effects can often be well seen on European farms adjoining Bantu reserves when one camp of each area is given a season's rest, e.g. in the Victoria East division; here the rested camp on the farm will, with few exceptions, produce only a tall, open growth of *Sporobolus*, *Digitaria* and *Aristida* whereas the rested camp in the reserve will often produce a dense growth of *Themeda* and other climax species. This can be very surprising if one has not previously got down on one's hands and knees and examined the half-inch growth of grass in the reserve, to discover it to consist of all the climax species. In the former case, selective grazing has removed the climax species; in the latter case, heavy non-selective grazing has preserved them, at least in places where erosion has not removed them bodily along with the soil. This interesting observation can lead one directly to the most fundamental principle of grazing management, viz. that grazing should be heavy for limited periods and must not be continuous. It must be alternated with periods of resting. Close observation also leads one to the conclusion that many of the Bantu reserves, especially in the sourveld of the Transkei, are not in such an appalling state as they are popularly supposed to be, and that reclamation of the

veld will be easy once rotational resting can be applied to it, providing soil erosion has not been excessive in the meantime.

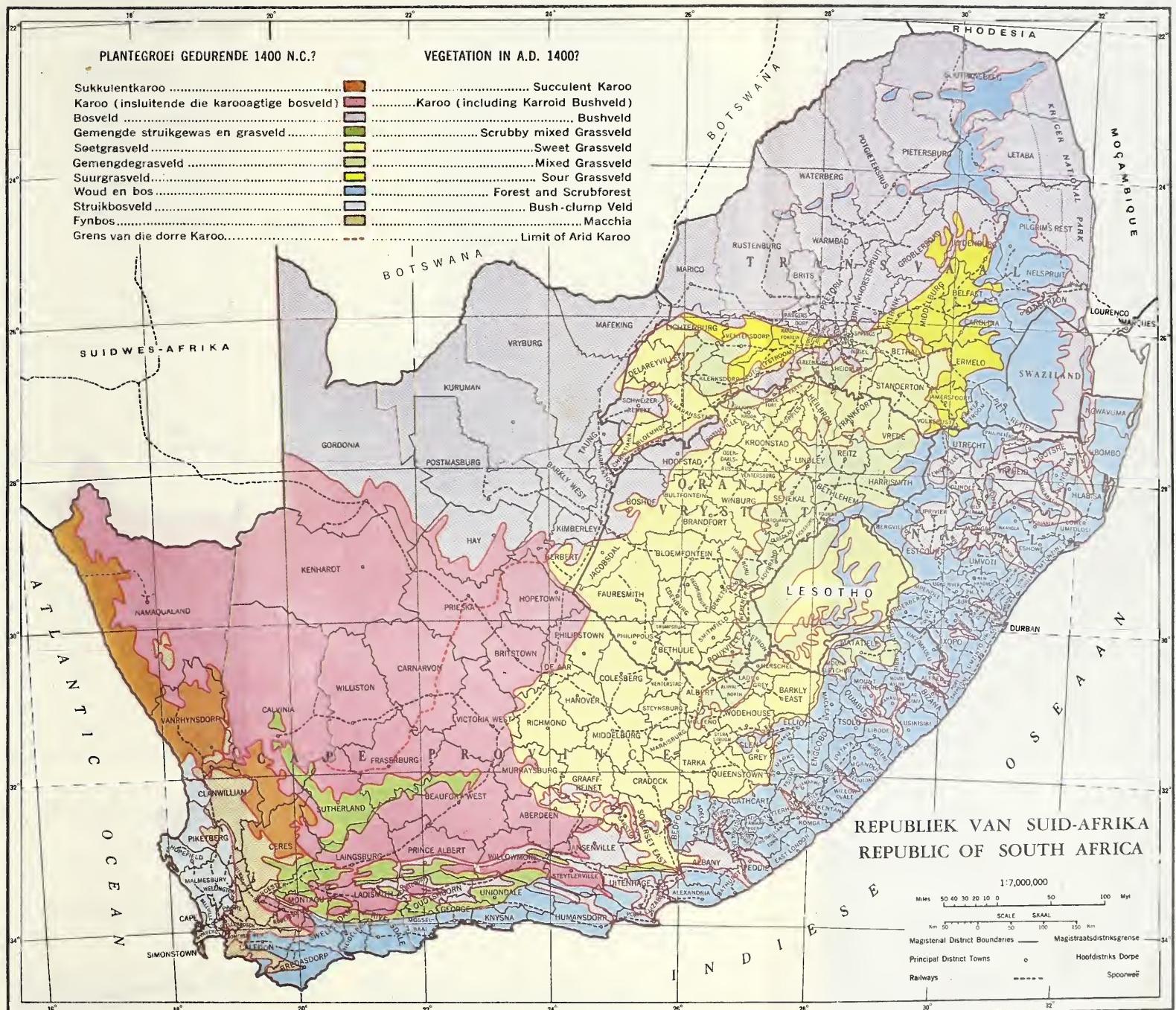
The effect of selective grazing is evident throughout the country; and it is mainly responsible for the virtual disappearance of grass from the Karoo and the development of such useless veld types as the 'Ngononi Veld. It must be emphasized that this survey has convinced the writer that there can have been no part of the Republic of South Africa which did not originally have a cover either of forest and closed scrub-forest or scrub, or of perennial grass, even in the winter rainfall area and in regions receiving less than 150 mm of rain per annum. The accepted idea of Karoo as being bare soil dotted with Karoo bushes (or, as H. V. Morton puts it, of Karoo bushes each in its own little desert) and occasionally covered with annual grasses and succulents, is a completely false one. That condition of bareness is an artificial one, and even to-day, in spite of the largely soilless and apparently grassless condition of the Karoo, perennial grasses are surprisingly plentiful when one starts looking for them. Moreover, they are always eaten flat, even grasses which in existing grassveld are not regarded as palatable, so that one must conclude that the most palatable grazing plants in the Karoo are still grasses, and that the Karoo bushes are valuable mainly as reserves for winter and droughts when there is no green leaf left on the grass tufts. It must also be realized that the great bulk of the Karoo bushes are unpalatable and that the unpalatable ones are steadily on the increase, a further result, of course, of selective grazing. The parts from which the perennial grasses and the better Karoo bushes have practically disappeared are the parts which have come to be regarded as useful only for goats and karakul sheep.

In the United States of America it has been calculated that the original population of game, when the European arrived, was two and a half times as great as the present population of domestic livestock, both calculated in cattle units; and yet the vegetation was far better then than it is to-day. In this country we have no numerical records of the game population, but, from general accounts, it was enormous; why then, when wild animals are replaced by domestic animals, does the veld deteriorate? A few reasons have been suggested. Firstly, there were a large number of different species of wild animals, and presumably they did not all have the same grazing habits and preferences. Secondly, the wild animals, with some exceptions, were dependent on natural surface waters; when these dried up, they had to move elsewhere or die, so that the veld was not grazed over and over again in search of the last overlooked stubble, and any rains which were too small to replenish surface waters were nevertheless available to the veld. The veld did get a chance to rest and grow. Thirdly, the wild animals were free to roam and they had a habit of congregating in large herds and "trekking", so that the veld was grazed heavily but intermittently, and not continuously. The old herding and kraaling system had one advantage, for at least some parts of the farm had a chance to rest, which is rarely so to-day.

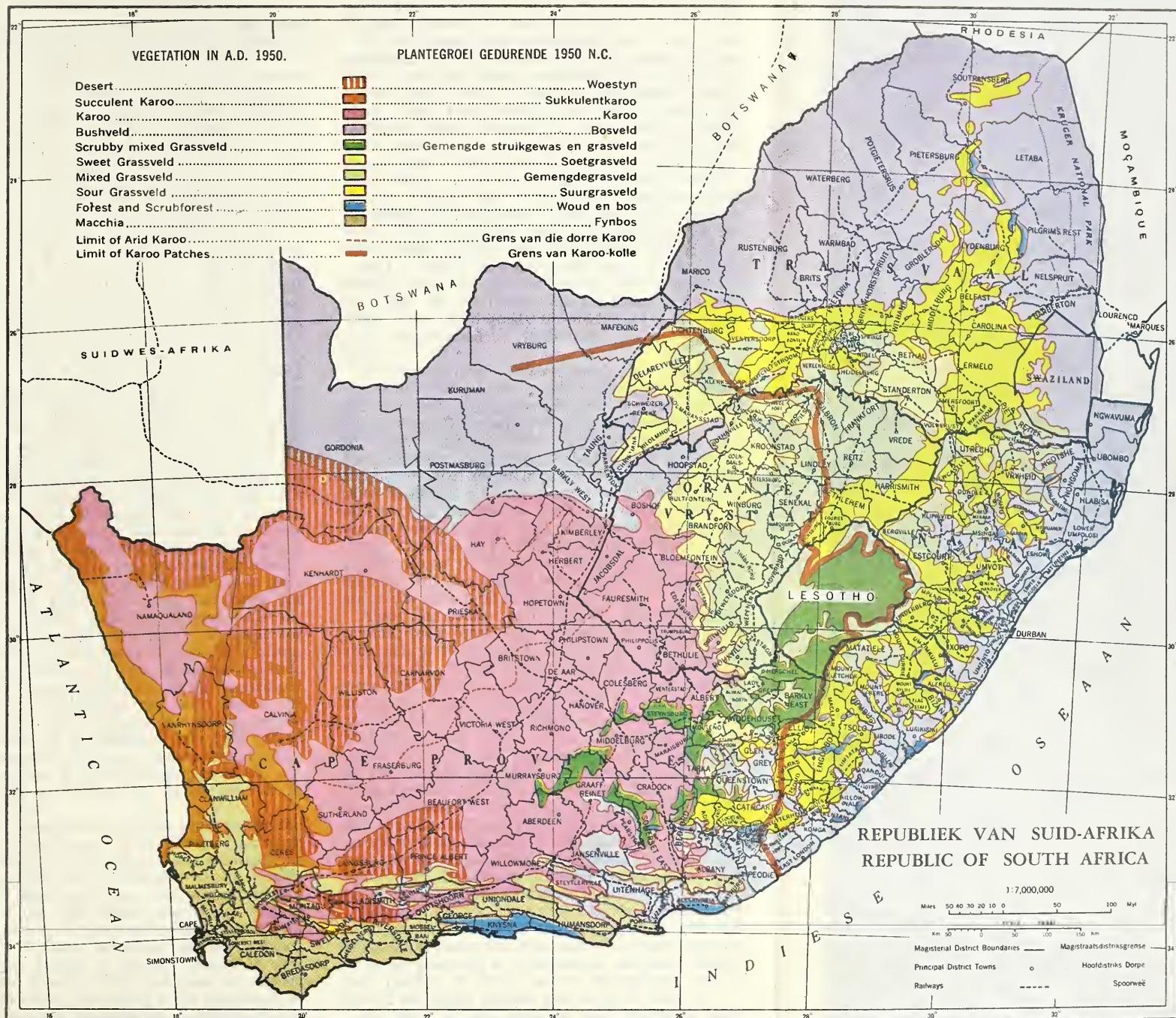
What are the consequences of continuous, selective grazing? Firstly, change in the species composition of the veld, good grazing species becoming eaten out and replaced by less useful species in the wetter parts, but

possibly not replaced at all in the drier parts, so that soil becomes exposed. Even in the wetter parts, the cover of the soil is reduced. That leads to the second effect, increased loss of water by run-off and sheet-erosion while wind-erosion may occur too. This reduces the depth and quality of the soil and makes the recovery of the vegetation, even if it is given a rest, slow and difficult. The shallower the soil in the first

place, the bigger this effect. Thirdly, due to increased run-off, rivers are called upon to carry more water after rains. The first effect of this is to silt the rivers up, filling pools, smothering the vlei vegetation; the next effect is that their channels become scoured out and deepened, so that water draining into them falls over a bank, and dongas start eating back.







Acocks Map No. 2

Gekleurde deur die Diégnoskemingsensoor 1951  
Drawn by the Topographical Survey Office 1951  
T.S.O. MISC /850

Herdruk in die Republiek van Suid-Afrika deur Die Staatsdrukker, Pretoria, 1975  
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# Recent and future changes in vegetation

## A DISCUSSION OF MAPS 1-5

Maps 1-5 are intended to show, in simple form, what the vegetation was (1), is (2) and (5), is likely to become (3), and could become if it were reclaimed (4).

**Map 1.** In drawing Map 1, there is no direct historical evidence to go on, i.e. evidence in the form of vegetation maps or botanical analyses of definite samples of veld that could be revisited and re-analysed today. What little evidence we have is indirect, e.g. the naming of Vasco da Gama of the East Coast as the Land of Fire, in reference to the multitude of veld fires he observed from the sea; Van Riebeeck's export of veld-hay from the Tygerberg to the East Indies; the rather vague descriptions of veld given by early travellers (Burchell, Barrow, etc.); the description by Davis, quoted by J. C. Brown in his "Hydrology of South Africa", of the start of the eastward movement of the Karoo; Moffatt's statements about the destruction of wild olives near Griquatown or of camelthorns in Botswana; and the mere fact that it was possible to travel by ox wagon through the Great Karoo to Graaff-Reinet and Beaufort West, with sufficient certainty of finding both grazing and water for the oxen, to justify a feeling of surprise if one did not find them (Kokot, 1948). This indirect evidence gives valuable clues and starting points for study; but for the rest (apart from memories of the older farmers, with nothing written down at the time in support of them), one is dependent on a study of the veld itself as it is to-day. All of the changes shown on the map can still be seen going on, so that there is no doubt about their reality; all that remains is to decide where they started. Fortunately, relic patches of formerly existing vegetation types can usually be found in spots suitable for their preservation, e.g. well cared for farms; rocky hillsides; edges of cultivated fields; the railway enclosure; cemeteries; camps set aside for the preservation of small herds of buck; cow camps of town commonages, and even along the roadside in parts of the country where fencing was carried out a long time ago. Otherwise, one must search the invaded area for relics of individual species, which should be typical of the displaced veld type and of veld types successional higher, and not occurring in the natural habitat of the invading type at all: e.g. *Tetrachne dregei* and *Rhus erosa* in the case of the Upper False Karoo.

The hardest boundaries to fix are those in flat and relatively flat country, e.g. in the Orange Free State and upper Karoo; but even here it will eventually be found that natural features however, vague, provide the probable boundaries, e.g. the original eastern boundaries of the Arid Karoo and Upper Central Karoo both consist of minor escarpments and chains of hills. After the latter boundary had been decided on, with many doubts, it received interesting confirmation when Schulze (1947) published his climate maps of South Africa. According to the classifications of both Köppen and Thornthwaite, a definite change in climate, *from temperate to tropical*, coincides with the supposed original boundary between Karoo and tropical grassveld. What would otherwise have been a highly controversial boundary thus becomes relatively unassailable.

**Map 2.** There is no difficulty about Map 2, because it is merely a simplified version of the veld type map, and in years to come it will be the basis for further comparisions.

Comparing Maps 1 and 2, we find the following changes suggested for the vegetation:-

(1) The forest and scrub-forest have largely disappeared. Scrub-forest was probably much more extensive than high forest, especially in the higher, more inland parts and on drier or waterlogged coastal plains. High forest would have been found in the shallower valleys, against escarpments and mountain sides which receive mist from the sea, and along the upper parts of the south-facing sides of the major river valleys, i.e. in the same situations where it persists to-day, but very much more extensive; shortening to scrub-forest on exposed ridges and flats in the colder and drier parts. It is probable that the upper parts of the north-facing sides of the deep valleys, as well as the upper middle parts of the valleys, where conditions are too cool for the bushveld of the valley and yet too dry for the forest and scrub-forest, were open, grassy thornveld and bush-clump veld, characterized by *Acacia caffra* just as they are to-day.

Northwards into warmer country, the high forest would have been more extensive, covering the ridges too, as it still does sometimes, e.g. in Zululand and the Eastern Transvaal; but in these northern parts, with their very dry winter, high plains would still have had only scrub-forest, owing to their frostiness. Regeneration of forest in a frosty area is extremely slow, because it can only proceed by outward growth of surviving patches of forest; in the presence of regular burning of the veld, this growth becomes still slower, because of the inflammability of the scrubby pioneer stages of the forest succession. This inflammability will also explain why relics of scrub-forest are to-day rarer than relics of high forest.

Along the south coast, with its well distributed rainfall, high forest was extensive in mountainous areas and it is here that the biggest areas of forest survive; but on the drier coastal plains, conditions were right only for scrub-forest, and, at the southern end of the west coastal plain, with its winter rainfall and hot, dry summers, there was probably only a bush-clump veld. These coastal plains have been so extensively cultivated that to-day there is very little of the natural vegetation remaining, most of this being Fynbos and Rhenosterveld, but there are traces of scrub-forest all through it, sometimes still so dense as to be quite impenetrable. Some of this scrub-forest on the west coastal plain is semi-succulent, and there probably was a transition, in the ploughed-up country south of the Piquetberg, from the coastal scrub-forest to the Namaqualand Broken Veld.

North-eastwards, the forest has been replaced by sour grassveld at higher altitudes, by thornveld and bushveld at lower altitudes, and by a certain amount of mixed grassveld at intermediate altitudes. Numerous patches of forest survive throughout; only a few of the bigger patches are shown in Map 2.

(2) Most of the bushveld and thornveld have persisted; but in northern parts, at higher altitudes, marginal bushveld has tended to be converted into grassveld, largely as a result of excessive burning. In recent years, burning has become less popular and the bushveld is tending to recover, e.g. on the Pietersburg Plateau. Southwards, thornveld has replaced a good deal of the forest and is actively replacing the grassveld which resulted from the destruction of the more temperate forest and scrub-forest of the Eastern

Cape, as well as much of the Dry *Cymbopogon-Themeda* veld, e.g. in the Queenstown area. The karroid bushveld (which should be rather called succulent bushveld) is shrinking in area, being replaced by Karoo and Karroid Broken Veld. In Griqualand West and the Eastern Cape, bushveld and thornveld are being invaded by Karoo; in the former case also by desert trees and shrubs, notably *Acacia mellifera* subsp. *detinens*, which tend to form thickets (as do such species as *Acacia luederitzii* var. *luederitzii*, *A. tenuispina* and *Dichrostachys cinerea* subsp. *africana* in the Transvaal), and spoil the open, grassy nature of the veld, reducing its grazing value.

(3) The most striking, and alarming, change is the spread of Karoo at the expense of sweet grassveld. This spread of the Karoo eastwards has amounted to 250 km in parts; it is still proceeding, as the red line indicating the limit of patches of Karoo shows, and the broken red line which indicates the limit of isolated individuals of the Karoo pioneers. These pioneers are well into the sourveld, and, in parts, have penetrated to the country east of the Drakensberg. The Upper Central Karoo, the Orange River Broken Veld, the Karroid Broken Veld and the Lower Central Karoo are all involved in this movement. There is also a northward movement, which has hitherto been much slower, but is showing signs of acceleration in recent years.

(4) Just as these wetter Karoo types are invading grassveld and bushveld, so too is the Arid Karoo invading the Upper Central Karoo, and the Succulent Karoo is invading the Arid Karoo and Western Mountain Karoo. The last movement is relatively small, so far, because the Succulent Karoo is rather a winter rainfall type and not so well adapted to the autumn rainfall areas which it is invading; in consequence it is a very poor, weedy type of Succulent Karoo which advances eastwards, scarcely to be distinguished from desert. There is another Succulent Karoo movement, rather more vigorous, from the Great Karoo, up the Great Fish River valley and into the False Karoo of the Middelburg and Hofmeyr areas, but not forming a definite succulent veld. There are no sharp boundaries to these internal Karoo changes, the Karoo tending to become a general mixture of all types, with the pioneers of the Succulent Karoo and Arid Karoo already penetrating almost as far as the False Karoo boundary in the east.

(5) Very extensive near deserts have developed in the west; rarely total desert in the sense that there is no vegetation at all, but near desert in the sense that soil erosion is universal and that there is no longer a permanent, unbroken vegetation cover, and only rarely a temporary cover. Only the bigger areas are shown in Map 2; smaller areas occur almost to the eastern boundary of the False Karoo.

(6) The Fynbos shows the biggest movement of all, having spread from the neighbourhood of Bredasdorp, Montagu and Touws River, to Grahamstown; it is now invading the Amatola Mountains. The vegetation of this area appears to have been a scrubby sort of mixed to sour grassveld wherever conditions were not suitable for forest or scrub-forest, and this grassveld would have replaced any forests that were destroyed. The fynbos species occurred all through, both as patches of Fynbos in rocky places, and in the subordinate position of forbs in the grassveld, just as they still do, e.g. at Swellendam. There is little doubt that grassveld first replaced the scrub-forest of the coastal plains; indeed, small patches of *Themeda*-dominated mixed veld, as dense as any in the country, can still be found in the Coastal Rhenosterveld and Coastal Fynbos, nearly to the west coast. They occur

in areas too wet or too stony ever to have been cultivated, i.e. the only areas that have not been cultivated. And even in the heart of the winter rainfall area on relatively dry and warm aspects, resting of the Fynbos will produce a dense stand of *Hyparrhenia hirta* and *Themeda*, e.g. on the western slopes of Constantiaberg or in Tulbagh Kloof; while in the eastern part of the area, e.g. around Humansdorp, much of the vegetation is still grassveld, with Fynbos only in patches.

Such phenomena as the thickening up of *Athanasia acerosa* in parts of the mist-belt of Natal, of *Stoebe vulgaris* and *Helichrysum kraussii* around Johannesburg, and of *Cliffortia repens* and *Passerina filiformis* on the mountains near Vryheid, might reasonably be taken as a warning that this movement of the Fynbos has by no means reached its limit. Moreover, the Karoo which has invaded the inland parts of the scrubby mixed grassveld, the upper parts of the Karroid *Merxmuellera* Mountain veld and parts of the *Themeda-Festuca* Alpine veld, is that tall form of Karoo which may be claimed to be transitional to Fynbos, including species of *Elytropappus*, *Cliffortia*, *Passerina*, *Pentzia cooperi*, *Eumorphia*, sometimes even of *Philippia*, *Erica* and *Muraltia*, and so closely related to Fynbos that it is a debatable point whether it should not rather be counted as a Fynbos invasion.

(7) In various parts of the Republic there are vague and insidious movements of *Acacia karroo*. It appears to be, by nature, a widely distributed species, perhaps having a successional position between the tropical forest and the busveld, but growing also on river-banks in the Karoo, where there is an assured supply of underground water, even if the environment is otherwise inhospitable. It is now spreading eastward up the river valleys into higher altitudes in the Karoo and beyond into the grassveld. It appears to be at home on the low escarpment that runs through the Free State from the neighbourhood of Koppies to Bloemfontein, and is thickening up and spreading there, e.g. between Bloemfontein and Brandfort; but odd specimens are also to be found in the heart of the Free State plains, while extensive thickets are developing in the grassveld of the Western Transvaal; these occurrences are usually associated with over-grazing and erosion and Karoo invasion, suggesting that even these parts are threatened by the development of Karroid Broken Veld. These movements are still too small to show on a small scale map.

There is also a westward movement of *Acacia karroo*, on a bigger scale, from the Valley Bushveld of the East Coast rivers into the grassveld of the Eastern Province and Transkei, and right into the surviving temperate forests of the mountains. This movement is not always preceded by over-grazing and soil erosion, and there are parallel invasions by this and other species (*Acacia nilotica* subsp. *kraussiana*) into open savanna in the Transvaal and Natal; the reason is likely to be climatic deterioration. This westward movement of *Acacia karroo* in the Eastern Cape already overlaps the eastward movement of the Karoo, resulting in a form of Karroid Broken Veld (the *Acacia-Pentzia* Community of Adamson). Only the larger movements are indicated on the map, but minor movements are to be seen in the valley of nearly every east coast river, though in the Transkei they are limited by the scarcity of firewood.

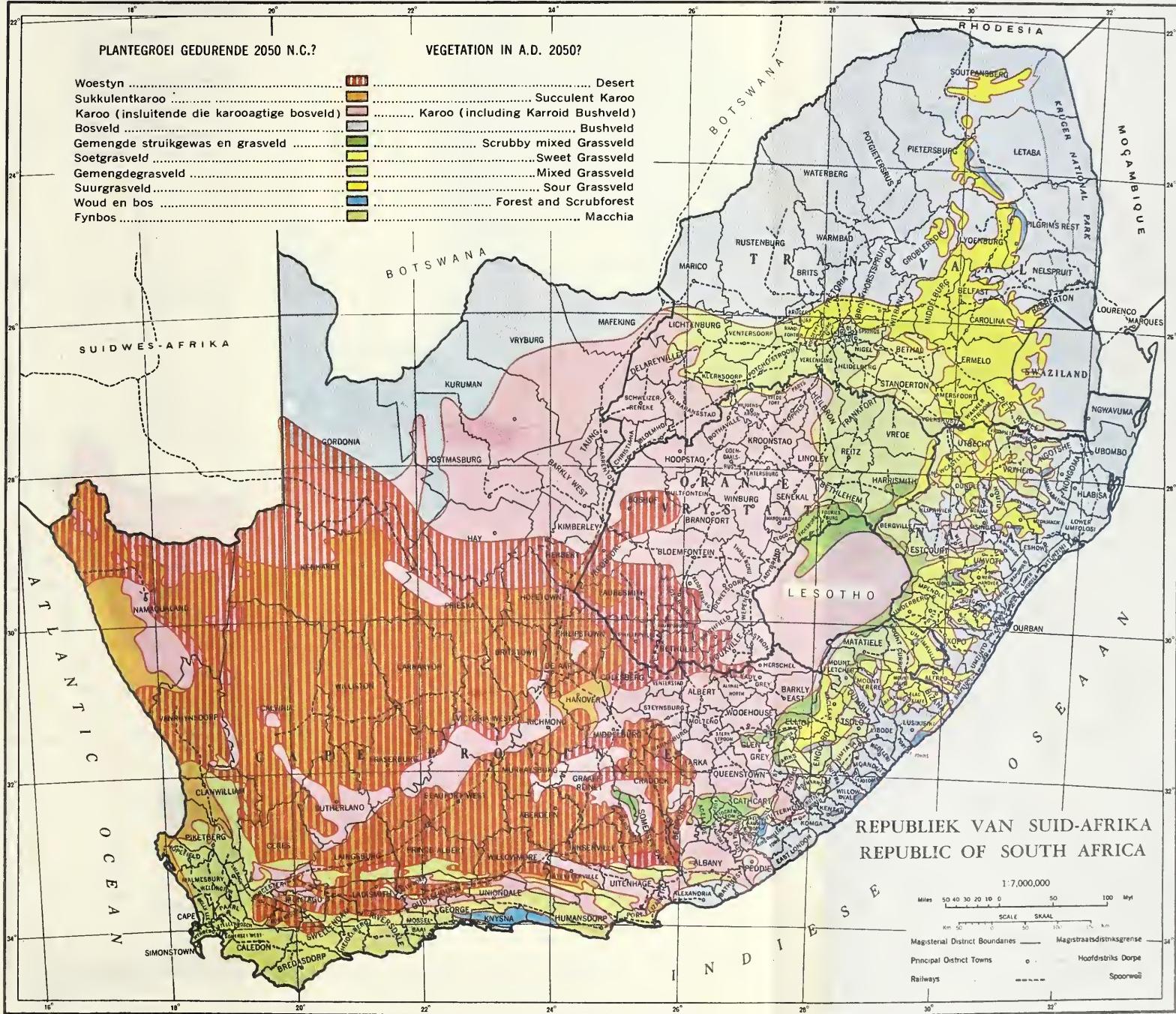
(8) Besides spreading at the expense of the forest and the sour bushveld, sour grassveld has spread at the expense of the mixed grassveld, as a result of selective grazing.

(9) Similarly, mixed grassveld has spread at the expense of bushveld and sweet grassveld.

#### PLANTEGROEI GEDURENDE 2050 N.C.?

## VEGETATION IN A.D. 2050?

Woestyn .....		..... Desert
Sukkulenkaroo .....		..... Succulent Karoo
Karoo (insluitende die karooagtige bosveld) .....		..... Karoo (including Karroid Bushveld)
Bosveld .....		..... Bushveld
Gemengde struikgewas en grasveld .....		..... Scrubby mixed Grassveld
Soetgrasveld .....		..... Sweet Grassveld
Gemengdegrasveld .....		..... Mixed Grassveld
Suurgrasveld .....		..... Sour Grassveld
Woud en bos .....		..... Forest and Scrubforest
Fynbos .....		..... Macchia



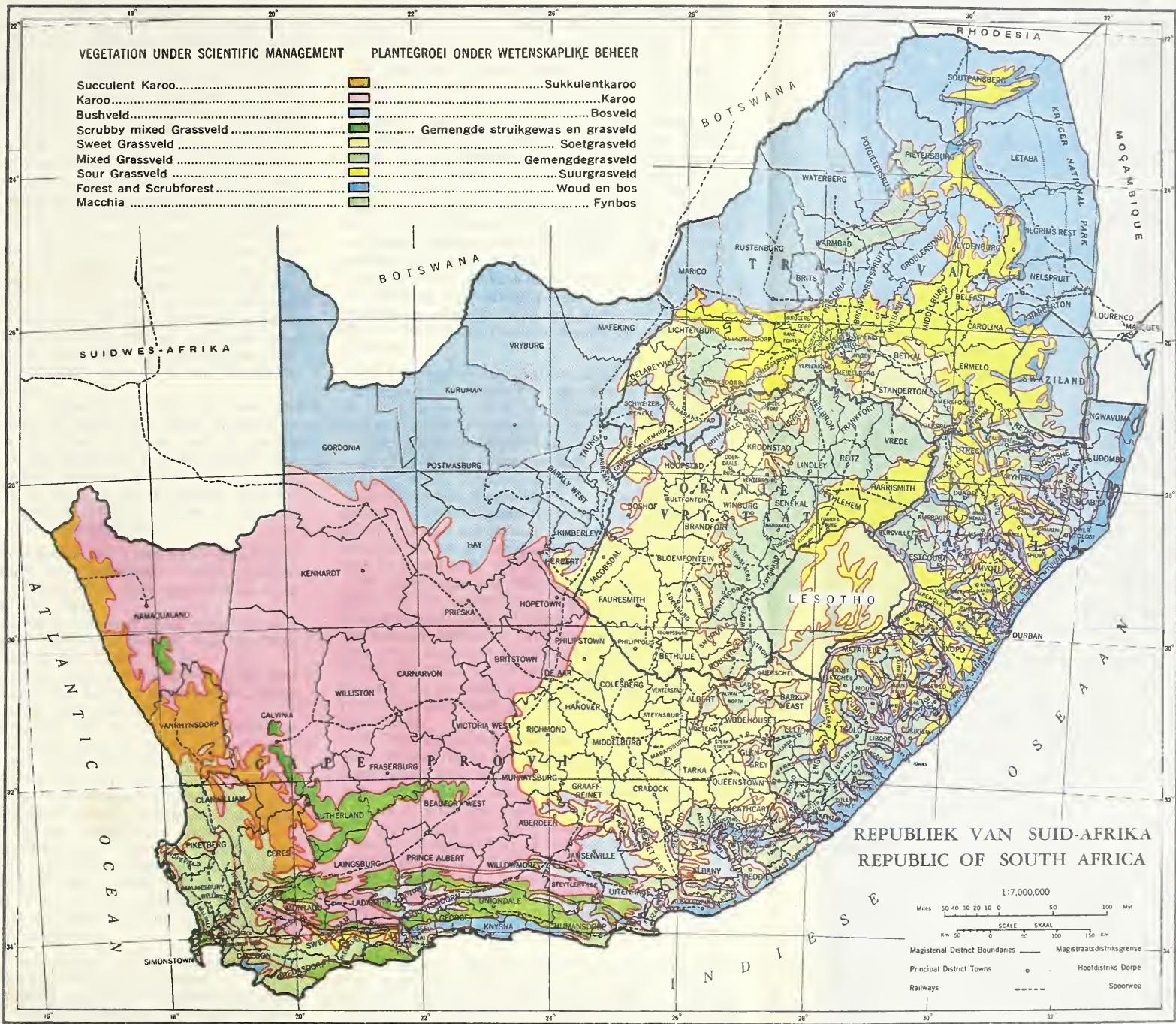
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## VEGETATION UNDER SCIENTIFIC MANAGEMENT

## PLANTEGROEI ONDER WETENSKAPLIKE BEHEER

Succulent Karoo.....	Sukkulenterkoo
Karoo.....	Karoo
Bushveld.....	Bosveld
Scrubby mixed Grassveld.....	Gemengde struikgewas en grasveld
Sweet Grassveld.....	Soetgrasveld
Mixed Grassveld.....	Gemengdegrasveld
Sour Grassveld.....	Suurgrasveld
Forest and Scrubforest.....	Woud en bos
Macchia .....	Fynbos



Getekken deur die Driehoekskartograafkantoor 1951  
Drawn by the Triangulation Survey Office 1951  
T.S.O. MISC/852

Herdruk in die Republiek van Suid-Afrika deur Die Staatsdrukker, Pretoria 1975  
Reprinted in the Republic of South Africa by The Government Printer, Pretoria 1975

Acocks Map No. 4



(10) There is little sign of movement of the Kalahari thornveld; indeed, it seems rather to be retreating, much of it having become thinned out almost to grassveld. This is not indicated on the maps.

These mappable changes are gross changes; in addition there are subtler changes within the veld types, in the relative abundance of the species composing them. This sort of change is difficult to assess and is done by a study of relics; it is sometimes difficult to see that a change has occurred, e.g. in a forest the only indication may be the discovery of a fallen-in and overgrown saw-pit. These changes become most important when they lead to a breaking of the grass cover; Map 5 shows, on broad lines, where this has occurred and where in consequence, general soil erosion is almost inevitable. Map 5 also shows where deterioration has gone so far that near-deserts have developed; it should perhaps be pointed out that the survey of these areas was made during the recent severe drought, so that Map 5 may be a little pessimistic. On the other hand, it may be a true picture, because it was not obscured by temporary growth. In any case, these areas are not uniformly bad, because individual farmers have succeeded in keeping the veld in good condition, and some have even reclaimed it; such farms are conspicuous from afar on occasions when visibility is not limited by the dust of erosion.

**Map 3.** Now, remembering what has been said about the position of karoo and desert pioneers, of *Acacia karroo*, of desert outposts and of general deterioration in the vegetation and the climate, consider Map 3, which attempts to show what the state of the country is likely to be in another hundred years' time if nothing effective is done to halt the deterioration. It is considered that:—

(1) The present Karoo and False Karoo will largely have degenerated into near-desert False Succulent Karoo, except in some of the more mountainous areas and in areas of deep sand.

(2) The False Karoo will have spread approximately to the present limit of Karoo patches, and may have established itself in the Tugela valley.

(3) The succulent bushveld types will have been replaced by Karoo and Karroid Broken Veld, except in the valleys of the east coast belt.

(4) Sour grassveld will be retreating before the development of poor types of mixed grassveld.

(5) The scrubby mixed grassveld and its associated near-Fynbos scrub, will have moved eastwards and northwards to the Winterberg and Drakensberg and into Natal; it might well have become more extensive in those parts and northwards than shown.

(6) Sweet grassveld may succeed in holding on to the turf highveld, but will have disappeared elsewhere.

(7) Bushveld will have spread into more of the grassveld areas. This map is an optimistic estimate of the changes that are likely to occur, being based on the following assumptions:

(1) That the country east of the Drakensberg will suffer relatively little climatic disturbance.

(2) That the sandy lands of the Eastern Free State and Western Transvaal will not start blowing *en masse*. There is a good deal of superficial dust movement already, a fact which was impressed on the writer's mind during his first trip on this survey, when travelling over the mountains from Utrecht to Wakkerstroom in July, 1945. The view to the south was completely obscured by the dust coming over the Drakensberg from the west; this is, of course, of common occurrence, even as far south as Estcourt.

(3) That the Kalahari, at present a buffer between the northern parts of the Republic and the growing

deserts of South West Africa, will not be carelessly opened to grazing by provision of water, without very strict control of the grazing being maintained.

(4) That the Fynbos invasion will not go further than the Amatolas.

(5) That there will be neither a marked improvement in the climate, nor a marked deterioration, other than the minor sort of change already discussed.

If these assumptions, particularly No. 3, are not justified by events, far more serious changes may occur.

**Map 4.** Turning from this ugly picture of what could be, consider Map 4, which is also a picture of what could be, but a pleasant picture. It represents the condition of the vegetation which, it is considered, consistent application of sound farming practice could have maintained; it is also the condition to which, so far as is now possible, the vegetation will have to be reclaimed before any sort of stability in South Africa's agriculture can be reached. It differs little from Map 1, except that it shows a far smaller area of forest and scrub-forest. Comparing Maps 1, 2 and 4, and remembering what has been said above, it will be seen that the objects of reclamation are considered to be as follows:—

(1) The near deserts in the west must be reclaimed, ecologically a relatively simple matter, because the powers of recovery of these arid veld types are amazing and they are less handicapped by climatic change than are the veld types further east.

(2) The False Succulent Karoo must be pushed back to where it belongs in the winter rainfall area.

(3) The False Karoo must be reclaimed to sweet grassveld. This is going to be the most difficult job of all, because soil erosion has made conditions unsuitable for the grassveld, and complete restoration may be found to be impossible.

(4) Mixed grassveld must be restored to the coastal plains of the South-west Cape, in place of Coastal Rhenosterveld and Coastal Fynbos. Improved methods of cultivation will demand this change, as well as a reduction of the area under cultivation. Where the grass is still present amongst the bushes, this will not be difficult, but where there is no grass, re-seeding and clearing of the bush will have to be resorted to.

(5) Scrubby mixed grassveld and mixed grassveld must be restored to the mountains of the Karoo and south coast belt, in place of Mountain Rhenosterveld, False Karoo and False Fynbos. Again, the amount of grass still present will decide whether this will be an easy job or a difficult one. Tidmarsh's work in the Sneeuwberg shows that in the absence of grass it can be very difficult.

(6) A good deal of mixed grassveld must be reclaimed to sweet grassveld.

(7) A good deal of sourveld could, with advantage, be converted into mixed veld, particularly the Dohne Sourveld.

(8) The east coast thornveld should be converted into mixed grassveld and sour grassveld; and so should some of the more open Transvaal bushveld types. This means that only a few shade trees, patches of bush and all patches of forest should be kept, all scrubiness being cleared away.

(9) Large areas of natural forest should be restored along the east coast and on mountains, especially the major escarpments. Smaller patches should be re-established on excessively steep places, at the heads of streams and along streams. The use of exotics wants more investigation; they appear to be extravagant with water, and although they may not transpire faster, the writer's observations suggest that

they transpire longer, i.e. they may go on growing and transpiring long after the indigenous trees have become wilted and dormant.

(10) The karroid (or succulent) bushveld should be restored.

The essential feature of all this reclamation (except in the case of forests, of course) is the re-establishment of a cover of useful grasses. This applies to every corner of the country. In many cases weedy types of vegetation will have to be eliminated, sometimes before reclamation can start, sometimes during reclamation, but the rule must be established that *no clearing must be done unless it is known with certainty how to cover the soil with other vegetation at once, and until suitable steps have been taken to do this.* Otherwise erosion will result, as it has resulted from the destruction of prickly-pear; and the remedy may be worse than the complaint.

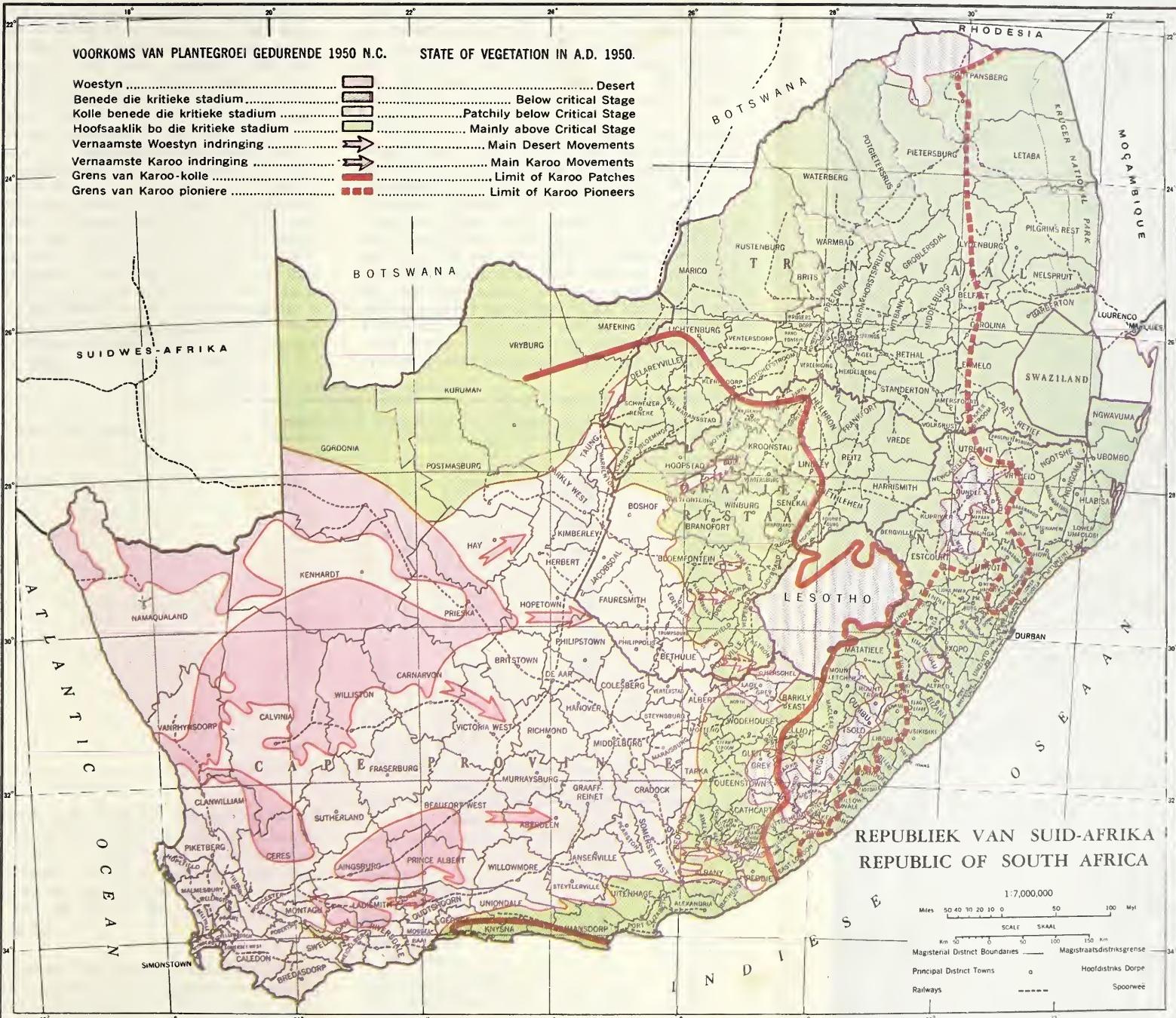
**Map 5.** The widespread deterioration in all veld types over the last 500 years is indicated in the discussion of Map 2. The extent to which such damage can be repaired by relatively simple methods, such as resting and rotational grazing, depends on how far the deterioration has progressed. The breaking down of the plant cover inevitably leads to loss of soil and a consequent reduction in the effectiveness of the rainfall. Eventually a stage is reached when so much soil has been lost that even complete resting will not result in recovery of the vegetation covered within a reasonable period of time.

In the course of this deterioration in the vegetation a stage is reached in which the vegetation, in particular the grass, is just able to protect the soil against erosion. This is the critical stage; any further deterioration is likely to result in general soil erosion.

VOORKOMS VAN PLANTEGROEI GEDURENDE 1950 N.C.

STATE OF VEGETATION IN A.D. 1950.

- Woestyn ..... Desert  
 Benede die kritieke stadium ..... Below critical Stage  
 Kolle benede die kritieke stadium ..... Patchily below Critical Stage  
 Hoofsaklik bo die kritieke stadium ..... Mainly above Critical Stage  
 Vernaamste Woestyn indringing ..... Main Desert Movements  
 Vernaamste Karoo indringing ..... Main Karoo Movements  
 Grens van Karoo-kolle ..... Limit of Karoo Patches  
 Grens van Karoo pioniere ..... Limit of Karoo Pioneers



REPUBLIEK VAN SUID-AFRIKA  
REPUBLIC OF SOUTH AFRICA

1:7,000,000

Miles 50 40 30 20 10 0 50 100  
Km 50 40 30 20 10 0 50 100  
Magisterial District Boundaries  
Principal District Towns  
Railways  
Scale Skaal  
Magistralsdistriksgrense  
Hoofdstadsdorp  
Spoorweë

Getekken deur die Drieboekmetingskantoor 1951.  
Drawn by the Trigonometrical Survey Office 1951.  
T.S.O. MISC/853

Herdruk in die Republiek van Suid-Afrika deur Die Staatsdrukker, Pretoria, 1975.  
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Acocks Map No. 5



## Description of the veld types

The description of the veld types which follows is to be regarded as a preliminary one. A great mass of data has been collected in the course of this survey and earlier (Map No. 6). It has been partially sorted out, but requires further study; moreover, although some of the veld types could be described in great detail even at this stage, others cannot until additional data have been collected. The method that has been used more or less intensively for the past 15 years in collecting data for a description of the vegetation of the Republic is as follows. The worker selects a representative sample of veld in good condition and walks around entering the names of all species encountered (at the moment of finding them—this is important) on a field sheet until no further species can be added (cf. minimal area). The distance one has to walk, and the time needed, varies with the veld type; thus a sample of Karoo flats or of the Free State plains can be taken adequately in 20 minutes, whereas a sample of a Karoo mountain may take three or four hours as a minimum. The longest list yet made included 302 species of the Scrub Bushveld of the

Species that are localized in occurrence in special habitats are given symbols, which have a corresponding reduction factor (Table 2). Thus, for example, if a species is very local (*II*), its abundance is multiplied by 1/100 and if it occurs in bush clumps (*bc*) the abundance is multiplied by  $\frac{1}{4}$ . The arbitrary numerical values of the habitat symbols may be modified to unit individual lists.

When a sufficient number of stands (the more the better) in each veld type has been examined, the data are presented in the form of a table; species are listed alphabetically at the left, stands along the top and abundance symbols in the matrix. This enables one to see at a glance which species are of general occurrence throughout a veld type, and thus typical of it; but to enable one to arrange the species in order of numerical importance, it is necessary to substitute the numerical values of the symbols and find the average number per morgen (0,857 ha) of each species. To prevent species which are very abundant in only a few stands from appearing unduly important, the average number per morgen (0,857 ha) for each species

TABLE 1.—Abundance classes and values

Abundance classes	Abundance symbols	Average spacing of plants	Number of plants per morgen*	Number of plants per hectare
Extremely abundant.....	vvab	1 in. 2,5 cm	12 960 000	15 122 520
Very abundant.....	vab	3 in. 7,6 cm	1 440 000	1 680 280
.....	ab+	4½ in. 11,4 cm	640 000	746 791
.....	ab	6 in. 15,2 cm	360 000	420 070
.....	ab-	9 in. 22,9 cm	160 000	186 698
.....	c+	1 ft 30,5 cm	90 000	105 018
Common.....	c	1½ ft 38,1 cm	57 600	67 211
.....	c-	1¾ ft 50,8 cm	32 400	37 806
.....	f+	2 ft 61,0 cm	22 500	
Frequent.....	f	3 ft 91,4 cm	10 000	26 254
.....	f-	6 ft 1,8 m	2 500	11 669
.....	ff+	12 ft 3,7 m	625	2 917
Fairly frequent.....	ff	15 ft 4,6 m	400	729
.....	ft-	20 ft 6,1 m	225	467
.....	o+	30 ft 9,1 m	100	263
Occasional.....	o	50 ft 15,2 m	36	117
.....	o-	75 ft 22,9 m	16	42
.....	r+	125 ft 38,1 m	6	
Rare.....	r	200 ft 61,0 m	2	19
.....	vr	300 ft 91,4 m	1	7
	& over			2
				1

\* 1 morgen = 0,857 hectare

Asbestos hills in a good season. The shortest list yet made included only five species, but this was a sample of badly tramped-out Arid Karoo in Bushmanland during a drought. A Karoo mountain will yield 180–230 species, whereas the Karoo flats will not yield more than 80, and some of the grassveld types not more than 40–50.

The abundance of each species based on the average distance between plants is then recorded by means of symbols. Thus, for example, *vvab* (extremely abundant) means that the plants are spaced 1 in (2,5 cm) apart giving 12 960 000 plants per morgen (0,857 ha) and *r* (rare), 200 ft (61 m) apart and two plants per morgen (0,857 ha). The abundance scale consists of 20 classes (Table 1). A capital letter used for the abundance symbol means that the plant concerned is conspicuous.

TABLE 2.—Habitat reduction factors

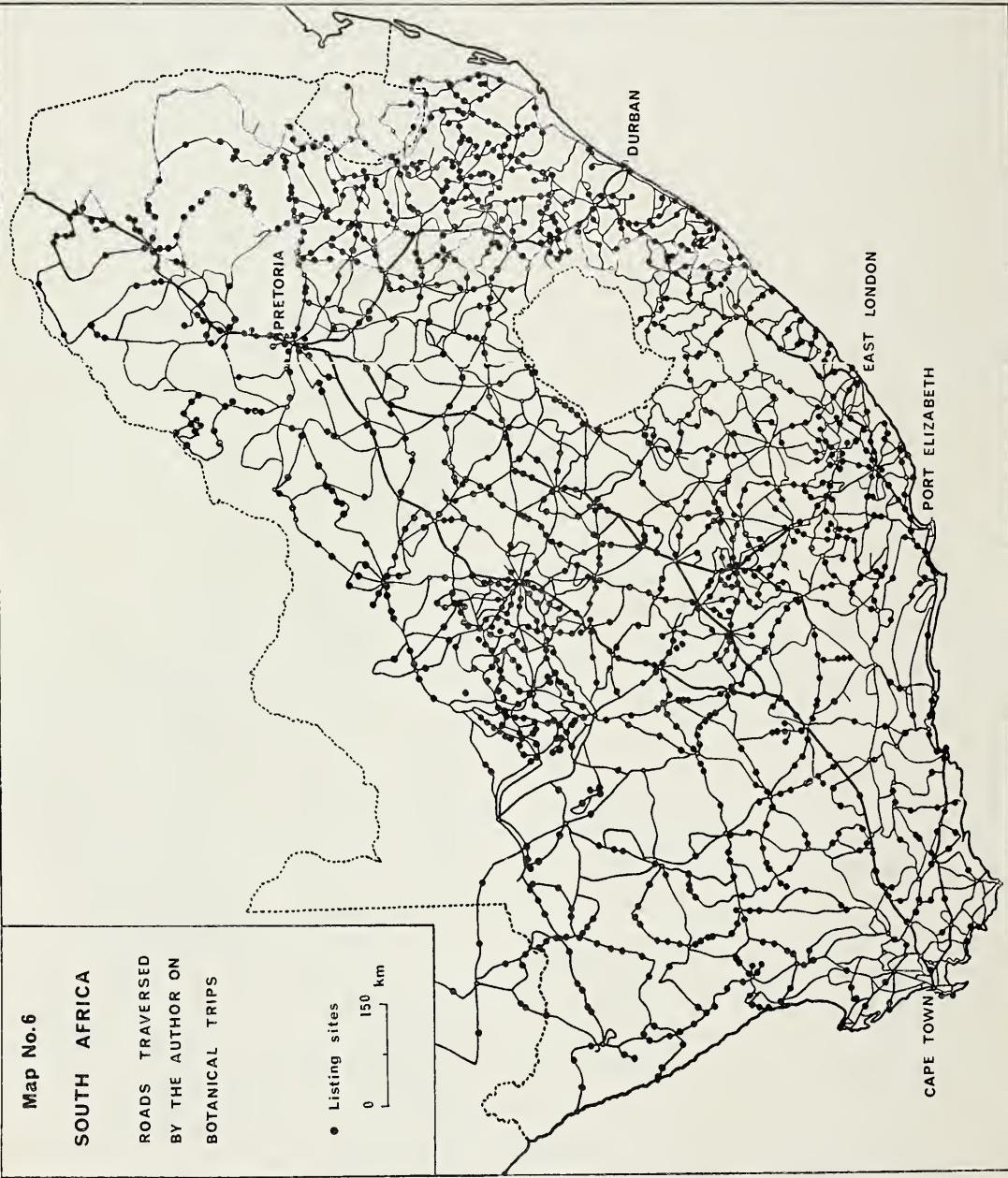
Habitat	Symbol	Reduction factor
local.....	I	$\frac{1}{10}$
very local.....	II	$\frac{1}{100}$
extremely local.....	III	$\frac{1}{1000}$
at the margin of.....	.m	$\frac{1}{10}$
on a krantz or rocky place.....	.e	$\frac{1}{100}$
along a temporary watercourse.....	.w	$\frac{1}{100}$
banks of a river.....	.W	$\frac{1}{100}$
by the roadside.....	.p	$\frac{1}{100}$
in the railway enclosure.....	.P	$\frac{1}{100}$
upper slopes and lower slopes.....	.↑, ↓	$\frac{1}{2}$
abundance not recorded.....	*	
in bush clumps.....	.bc	$\frac{1}{4}$
on E., W., N. or S. aspect.....	.E,W,N,S	$1, \frac{1}{2}, \frac{1}{3} \text{ or } \frac{1}{4}$
on termitaria.....	.a	$\frac{1}{100}$
hiding under bushes.....	.t	1
under trees.....	.T	1
in a depression.....	.h	$\frac{1}{100}$
in a pan.....	.H	$\frac{1}{100}$
in a vlei.....	.V	$\frac{1}{100}$
a small koppie.....	.k	$\frac{1}{100}$

**Map No.6****SOUTH AFRICA**

ROADS TRAVESED  
BY THE AUTHOR ON  
BOTANICAL TRIPS

• Listing sites

0 150 km



is multiplied by the number of stands in which the species occurs, and divided by the total number of stands examined. This gives what may be called Relative Abundance\*. The higher the proportion of the lists in which the species occurs, the more nearly will the Relative Abundance be the same as the average number per morgen (0,857 ha). It must be remembered that these figures are purely an estimate, and it has been observed that there is a tendency to over-estimate the spacing of the plants, so that they are likely to be a conservative estimate. Further, it takes many years to get to know every plant in the flora, so it is necessary to define the Relative Abundance tables as "conservative estimates of the number of plants of each species to be expected per morgen (0,857 ha) in typical samples of the veld types, within the limits of the writer's knowledge of the flora". Individual samples will show variations from the Relative Abundance table of the veld type, greater amongst the rarer and less readily recognizable species than amongst the common and permanently recognizable species.

It will have been noted that a sample of veld is "selected"; that is, the samples are not random, and they cannot be, because the object has been not to describe the veld simply as it is today after 50–300 years of what we know now to have been, in varying degrees, grazing mismanagement, but to describe it as it could be in its most useful form. This does not usually mean the climax, because, as has been said, reversal of the succession to some extent is often necessary and usually desirable, to bring the vegetation to its most useful state; that being so, we can expect to find samples of veld which for various reasons are more or less in this state. The picture of the veld that will be drawn, therefore, will be better than the average, but it will give an idea of the goal of reclamation. At the same time, we shall pay much attention to the climax, because we cannot understand the veld unless we know the climax.

An obvious prerequisite for the successful application of this method is that the worker has a thorough knowledge of the flora. Doubtful or unknown plants should be collected for identification in the herbarium.

## I COASTAL TROPICAL FOREST TYPES

### I COASTAL FOREST AND THORNVELD

The area shown as occupied by coastal forest is not all forest today, but in this area there can be no doubt that the whole area was naturally some form of forest. The veld today is a more or less open thornveld with numerous and extensive patches of forest. The grassveld constituent is rarely a pure, uniform grassveld, but is rather scrubby, full of tall herbs, shrubs and tall coarse grasses, showing how strong the successional movement towards forest is. The forest is mostly short (5–10 m high), very dense and tangled, especially towards the coast; but against the seaward-facing hills further inland it becomes taller and less tangled, about 20 m high, sometimes more. Its upper boundary is approximately the 450 m contour northwards, dropping to about 300 m southwards. It is evergreen, except for some of the largest trees in dry seasons (*Ficus natalensis*, *Calodendrum*, *Celtis* and *Erythrina caffra*).

Rainfall ranges from 900–1 500 mm per annum, i.e. nowhere insufficient for forest, but it comes in summer, so that the forest has to be of such a nature

as to be able to endure a dry winter. Frosts are light, though they sometimes occur even on the Natal coast; summer temperatures are high yet less than at some places further inland or in the winter-rainfall area, but feel oppressive because of the usually high relative humidity. It is noticeable that whereas the short forests are hot and stuffy places, the high forests are fresh and cool, even chilly, in spite of being extremely damp, and they are capable of condensing surprising amounts of water from the mists.

The forests of the coast-belt may be divided into five types:—

- (a) The typical forest in Natal and the Transkei
- (b) The Zululand palm-veld
- (c) The transitional type in the area between the Kei and Keiskama
- (d) The dune-forest, fairly uniform all along the coast
- (e) The Mangrove forest of the eastern coast.

#### (a) The Typical Coast Belt Forest

(See Taljaard, Photo 120; King, Fig. 187, 288; Adamson, Photo 3)

The commonest trees (Fig. 1) of general occurrence, i.e. occurring in 50 per cent or more of the samples, are:—

<i>Milletia grandis</i> ...	1 031	<i>Casearia gladiiformis</i> .....	16
<i>Protorhus longifolia</i>	111	<i>Trimeria grandifolia</i> .....	15
<i>Vepris undulata</i> ....	65	<i>Erythrina caffra</i> ....	10
<i>Combretum kraussii</i> .....	62	<i>Acacia karroo</i> (at margin).....	8
<i>Rhus chirindensis</i>		<i>Brachylaena discolor</i> .....	7
<i>forma legatii</i> .....	39	<i>Cussonia spicata</i> ...	7
<i>Ficus natalensis</i> ....	32	<i>Kiggelaria africana</i> .	6
<i>Celtis africana</i> ....	27	<i>Canthium mundianum</i> .....	5
<i>Trichilia emetica</i> ...	27		
<i>Harpephyllum caffrum</i> .....	22		

Trees of less general occurrence include:—

<i>Syzygium cordatum</i>	416	<i>Chaetacme aristata</i>	3
<i>Strychnos henningsii</i> .....	353	<i>Cussonia</i> sp.....	3
<i>Strelitzia nicolai</i> ....	263	<i>Ekebergia capensis</i>	3
<i>Erythroxylum pictum</i> .....	165	<i>Ficus capensis</i> ....	3
<i>Croton sylvaticus</i> ...	41	<i>Heywoodia lucens</i> ..	3
<i>Cryptocarya woodii</i>	28	<i>Millettia sutherlandii</i> ....	3
<i>C. latifolia</i> .....	7	<i>Vitellariopsis marginata</i> .....	3
<i>Macaranga capensis</i>	7	<i>Linociera foveolata</i>	3
<i>Ptaeroxylon obliquum</i> .....	4	<i>Olea capensis</i>	3
<i>Trema orientalis</i> ....	4	<i>subsp. macrocarpa</i>	3
<i>Apodytes dimidiata</i>	3	<i>Podocarpus latifolius</i> .....	3
<i>Cassine papillosa</i> ...	3	<i>Rapanea melanophloeos</i> ...	3
<i>Cassine aethiopica</i>	3	<i>Xymalos monospora</i> .....	3
<i>Cassipourea gummiflua</i> var.		<i>Schefflera umbellifera</i> .....	2
<i>verticillata</i> .....	3	<i>Albizia adianthifolia</i> ....	2

The high Relative Abundance of some of the less generally occurring species in this, and further lists, suggests that where these species occur they are important, and it indicates the great differences that one finds between different patches of forest.

\* Editor's note: relative abundance = average estimated density  
× absolute presence.

FIG. 1.—Typical Coast-belt Forest (1a) near the mouth of the Umtakaty River, south of Port St Johns in Pondoland. Species noted: *Combretum kraussii*, *Ficus* spp., *Vepris undulata*, *Trichilia emetica*, *Dalbergia multijuga*, *Brachylaena discolor* and *Cryptocarpus latifolia*.



Shrubs and climbers of general occurrence in the typical coastal forest are:—

<i>Uvaria caffra</i> .....	7 223	<i>Clerodendrum glabrum</i> .....	88
<i>Dalbergia obovata</i> .....	3 900	<i>Fagara capensis</i> .....	88
<i>Tricalysia lanceolata</i> .....	2 041	<i>Dovyalis rhamnooides</i> .....	65
<i>Entada spicata</i> .....	1 704	<i>Grewia lasiocarpa</i> .....	47
<i>Cissampelos torulosa</i> .....	1 531	<i>Canthium ciliatum</i> .....	44
<i>Asparagus setaceus</i> .....	1 493	<i>Allophylus melanocarpus</i> .....	34
<i>Oriaria bachmannii</i> .....	1 035	<i>Rhoicissus rhomboidea</i> .....	25
<i>Cissus fragilis</i> .....	1 017	<i>Helinus integrifolius</i> .....	20
<i>Senecio deltoideus</i> .....	359	<i>Asparagus virgatus</i> .....	19
<i>Grewia occidentalis</i> .....	121	<i>Carissa bispinosa</i> .....	9
<i>Flagellaria guineensis</i> .....	114	<i>Clausia anisata</i> .....	7
<i>Rhoicissus tomentosa</i> .....	91		

Shrubs and climbers of less general occurrence are very numerous; they include:—

<i>Indigofera micrantha</i> .....	1 439	<i>Berkheya bipinnatifida</i> .....	364
<i>Dioscorea dregeana</i> .....	1 273	<i>Trichocladus crinitus</i> .....	346
<i>Allophylus dregeanus</i> .....	861	<i>Maesa alnifolia</i> .....	276
<i>Smilax kraussiana</i> .....	744	<i>Diospyros simii</i> .....	273
<i>Excoecaria simii</i> .....	727	<i>Rubus rigidus</i> .....	261
<i>Acalypha glabrata</i> .....	675	<i>Vernonia mespilifolia</i> .....	259
<i>Tabernaemontana ventricosa</i> .....	675	<i>Duvernoia adhatodioides</i> .....	258
<i>Buxus natalensis</i> .....	497	<i>Peddiea africana</i> .....	249
<i>Buxus macowanii</i> .....	497	<i>Cestrum laevigatum</i> .....	166
<i>Rhoicissus tridentata</i> .....	457	<i>Calpurnia aurea</i> subsp. <i>sylvatica</i> .....	83
<i>Bequaertiadendron natalense</i> .....	434	<i>Cassia</i> sp. ....	35
<i>Burchellia bubalina</i> .....	431	<i>Gardenia amoena</i> .....	33
<i>Cnestis natalensis</i> .....	415	<i>Maytenus mossambicensis</i> .....	33
<i>Dracaena hookeriana</i> .....	415	<i>Psychotria capensis</i> .....	28
<i>Dalbergia multijuga</i> .....	390	<i>Tarenna pavettoides</i> .....	28

Small plants of the forest floor and margin of general occurrence are:—

<i>Oplismenus hirtellus</i> .....	193 808	<i>Prophytochloa prehensilis</i> .....	592
<i>Acanthaceae</i> ( <i>Phaulopsis</i> , <i>Isoglossa</i> , <i>Hypoestes</i> ).....	42 487	<i>Doryopteris concolor</i> .....	551
<i>Centella asiatica</i> .....	19 454	<i>Asparagus</i> sp. ....	523
<i>Cyperus albostriatus</i> .....	4 679	<i>Setaria chevalieri</i> .....	491
<i>Plectranthus ecklonii</i> .....	1 047	<i>Pellaea viridis</i> .....	336
		<i>Aneilema dregeanum</i> .....	8

Of less general occurrence are:—

<i>Panicum maximum</i> .....	4 802	<i>Plectranthus laxiflorus</i> .....	298
<i>Stenotaphrum secundatum</i> .....	4 606	<i>Panicum</i> sp. cf. <i>laticomum</i> .....	298
<i>Dactyloctenium australe</i> .....	3 421	<i>Pellaea viridis</i> var. <i>macrophylla</i> .....	274
<i>Anomatheca laxa</i> .....	1 117	<i>Misanthidium capense</i> .....	260
<i>Achyranthes aspera</i> .....	830	<i>Moraea iridioides</i> .....	250
<i>Hibiscus pendunculatus</i> .....	775	<i>Stangeria eriopus</i> .....	249
<i>Justicia campylostemon</i> .....	676	<i>Asplenium aethiopicum</i> .....	248
<i>Sclerochiton harveyanus</i> .....	675	<i>Desmodium repandum</i> .....	226
<i>Dicliptera clinopodia</i> .....	612	<i>Cyathula cylindrica</i> .....	165
<i>Aystasia gangetica</i> .....	476	<i>Panicum aequinerve</i> .....	112
<i>Cymbopogon validus</i> .....	419	<i>Stachys aethiopica</i> .....	112
		<i>Anthericum</i> sp. ....	83

and many more.

The Relative Abundance table includes a total of 372 species.

The forests being small patches, the species of the margin are unduly important. The indicators of this forest are:—

*Millettia grandis* and *Protorhus longifolia* as dominants. If *Strelitzia Nicolai*, *Croton sylvaticus*, *Macaranga capensis*, *Schefflera umbellifera* or *Syzygium cordatum* also occur, they will confirm it.

The more strictly tropical species are commoner northwards than they are southwards and with few exceptions do not cross the Great Kei River.

The thornveld (Fig. 2) which replaces this forest is scrubby, full of bush clumps, patches of forest and various stages in the succession between grass-veld and forest; only rarely is it an open grassy savanna. The grass tends to be tall, consisting of tall forms of *Themeda triandra* and *Digitaria* spp., *Hyparrhenia filipendula* and other species, *Cymbopogon validus* and *C. excavatus*, as well as the usual shorter species of the warmer grasslands, e.g.:

<i>Tristachya hispida</i> .....	Alloteropsis semialata
<i>Heteropogon contortus</i> .....	<i>Eragrostis plana</i>
<i>Loudetia simplex</i> .....	<i>E. racemosa</i>
<i>Paspalum orbiculare</i> .....	<i>Setaria sphacelata</i>
<i>Eulalia villosa</i> .....	<i>Panicum aequinerve</i>
<i>Diheteropogon amplexens</i> .....	<i>Chloris gayana</i>

FIG. 2.—Thornveld element of Typical Coast-belt Forest (1a) near Mandini on the Tugela River mouth road in Natal. *Acacia karroo* invading old lands.



with a great variety of forbs and tall bushes, e.g.:

<i>Hypoestes aristata</i>	<i>Indigofera eriocarpa</i> and others
<i>Tephrosia polystachya</i>	<i>Desmodium caffrum</i> and others
<i>T. macropoda</i>	<i>Leonotis leonurus</i> and others
<i>Cassia mimosoides</i>	<i>Eriosema squarrosum</i> and others
<i>Hewittia sublobata</i>	<i>Nidorella auriculata</i>
<i>Cephalaria attenuata</i>	<i>Pseudarthria hookeri</i>
<i>Lasiosiphon spp.</i>	<i>Senecio serratuloides</i>
<i>Lippia javanica</i>	
<i>Artemisia afra</i>	
<i>Pentanisia prunelloides</i>	
<i>Berkheya speciosa</i>	

This scrubiness would make the veld difficult to manage as purely grazing country, particularly as too heavy grazing encourages *Aristida junciformis* ('Ngongoni), which to-day is dominant over large areas; but the possibilities of growing pastures and fodder crops are so great that the veld is of minor importance in any farming system claiming to make full use of the potentialities of this area. The topography is steeply rolling, consisting of a maze of ridges between the numerous large and small rivers; rarely is there a rock out-crop and the soil is stable, so that soil erosion is, as yet, rarely to be seen, even though the natural vegetation has been entirely replaced by sugar-cane over large areas in Natal.

#### (b) The Zululand Palm Veld

The Zululand Palm Veld, lying mainly north of the Tugela, but with small outliers extending southwards past Durban, is associated with sandy soil on a badly drained coastal plain (Fig. 3). The forest is rather a short, tangled jungle in which lianas, palms and *Strelitzia Nicolai* are conspicuous, occurring in patches in a scrubby thornveld.

Important species in the jungle are:—

<i>Brachylaena discolor</i>	<i>Sclerocarya caffra</i>
<i>Acacia albida</i>	<i>Hyphaene natalensis</i>
<i>Canthium mundianum</i>	<i>Hippocratea sp.</i>
<i>Strelitzia Nicolai</i>	<i>Uvaria caffra</i>
<i>Parinari curatellifolia</i> subsp. <i>nobola</i>	<i>Combretum molle</i>
<i>Kraussia floribunda</i>	<i>Phoenix reclinata</i>
<i>Turraea floribunda</i>	<i>Trichilia emetica</i>
<i>Cussonia kraussii</i>	<i>Ficus stuhlmannii</i>
<i>Dalbergia armata</i>	<i>Cordia caffra</i>
<i>Tricalysia sp.</i>	<i>Apodytes dimidiata</i>
<i>Ochna natalitia</i>	<i>Syzygium cordatum</i>
<i>Clerodendrum glabrum</i>	<i>Landolphia kirkii</i>
<i>Diospyros pallens</i>	<i>Maytenus senegalensis</i>
<i>Acacia karroo</i>	<i>Spirostachys africana</i>
<i>Scutia myrtina</i>	<i>Nuxia oppositifolia</i>
<i>Clausaena anisata</i>	<i>Euclea natalensis</i>
<i>Ziziphus mucronata</i>	<i>Xylotheca kraussiana</i>
	<i>Albizia adianthifolia</i>



FIG. 3.—Zululand Palm-veld (1b) near Groutville on the north coast of Natal. *Phoenix reclinata* occurring in patches.

with *Panicum maximum*, *P. deustum* and *Justicia flava*. In the somewhat drier inland fringe, *Euclea schimperi* var. *daphnoides*, *E. undulata*, *Sarcostemma viminale*, *Acacia luederitzii* var. *luederitzii*, *Dinocanthium hystrix*, *Euphorbia ingens*, *E. evansii*, *E. grandicornis*, *Strychnos madagascariensis*, *Schotia brachypetala* and others may become important in a particularly dense and impenetrable form of this jungle. Where drainage is bad, the trees tend to adopt the habit of underground shrubs, with numerous shoots a few metres high, e.g. *Parinari curatellifolia* subsp. *mobola*. The vegetation of the swampy parts is an open, grassy palm-veld, mainly *Hyphaene natalense*.

The thornveld is usually open, with a dense, tall, scrubby grassveld consisting of:—

<i>Themeda triandra</i>	<i>C. plurinodis</i>
<i>Tristachya hispida</i>	<i>Eragrostis</i> sp. cf. <i>E. planiculmis</i>
<i>Diheteropogon amplexens</i>	<i>Hyparrhenia</i> spp.
<i>Imperata cylindrica</i>	<i>Euphorbia vandermerwei</i>
<i>Digitaria</i> sp.	<i>Brachiaria serrata</i> var. <i>serrata</i>
<i>Eragrostis superba</i>	<i>Elionurus argenteus</i>
<i>E. capensis</i>	<i>Sphenostylis marginata</i> subsp. <i>marginata</i>
<i>Perotis patens</i>	<i>Pachystigma venosum</i>
<i>Sporobolus nitens</i>	<i>Dolichos angustifolius</i>
<i>Heteropogon contortus</i>	
<i>Eragrostis plana</i>	
<i>Heichrysum kraussii</i>	
<i>Cymbopogon validus</i>	

*Aristida junciformis* (sometimes) and much besides, a rich flora. Little information is available about this veld.

### (c) Transitional Coastal Forest

Transitional Coastal Forest (Fig. 4) between the Kei and the Keiskama: this is very similar to the drier parts of the typical forest except that it lacks such species as *Macaranga capensis*, *Croton sylvaticus* and *Schefflera umbellifera*, while *Ptaeroxylon*, *Schotia* spp., *Cassine* spp. and *Euphorbia grandidens* tend to be more common and *Euphorbia triangularis* sometimes occurs, showing that it is transitional to the drier Alexandria Forest. The thornveld which replaces it is very similar to the Eastern Cape Province Thornveld (No. 7, p.24), but with such tropical species as *Dalbergia obovata* playing an important part. [See Adamson, Photo 8 (Thornveld).]

### (d) The Dune Forest

This occupies a narrow belt on the row of high dunes running down the east coast (Fig. 5), stunted on the seaward side, taller, up to 10 m, on the landward side. More of it survives than of any of the other forest types. If we include the flora of the beach and the mud-flats of the numerous estuaries, this becomes a particularly interesting forest ecologically, and it is hoped in the future to examine it more thoroughly than has hitherto been done. It has not been studied north of Isipingo nor south of Kariega Mouth. [See Marloth IV, Fig. 50; III, 1, Fig. 52A; II, 2, Fig. 147 (Thornveld); Reynolds, Pl. 70.]

The principal trees of general occurrence are:—

<i>Mimusops caffra</i> ...	3 022	<i>Strelitzia nicolai</i> ...	94
<i>Euclea natalensis</i> ...	2 324	<i>Sideroxylon inerme</i>	71
<i>Canthium</i>		<i>Tarchonanthus</i>	
<i>obovatum</i> .....	1 110	<i>camphoratus</i> var.	
<i>Apodytes dimidiata</i>	642	<i>camphoratus</i> ...	66
<i>Brachylaena</i>		<i>Scolopia zeyheri</i> ...	46
<i>discolor</i> .....	267	<i>Ficus burtt-davyi</i> ...	36

Three of less general occurrence are:—

<i>Canthium</i>		<i>Hyphaene natalensis</i>	
<i>mundianum</i> .....	847	(northwards)....	6
<i>Cassine aethiopica</i>	517	<i>Strychnos spinosa</i> ..	6
<i>Phoenix reclinata</i>	190	<i>Cordia caffra</i> .....	5
<i>Acacia karroo</i> .....	47	<i>Hippobromus</i>	
<i>Deinbollia</i>		<i>pauciflorus</i> .....	5
<i>oblongifolia</i> .....	25	<i>Ziziphus mucronata</i>	4
<i>Linoeiera foveolata</i>	20	<i>Harpephyllum</i>	
<i>Trichilia emetica</i> ..	20	<i>caffrum</i> .....	3
<i>Euphorbia</i>		<i>Millettia grandis</i> ...	2
<i>triangularis</i> .....	16	<i>Erythrina caffra</i> ...	2
<i>Schotia</i>		<i>Ficus capensis</i> ....	2
<i>brachypetala</i> .....	8	<i>F. natalensis</i> ....	1
<i>Pterocelastrus</i>		<i>Albizia</i>	
<i>tricuspidatus</i> ....	7	<i>adianthifolia</i>	
<i>Euclea natalensis</i> ...	6	(northwards)....	1

The generally occurring shrubs and climbers in the Dune Forest are:—

<i>Scutia myrtina</i> .....	8 875	<i>Dolichos lablab</i> ...	666
<i>Allophylus</i>		<i>Chrysanthemoides</i>	
<i>natalensis</i> .....	3 872	<i>monilifera</i> .....	440
<i>Dracaena</i>		<i>Secamone alpini</i> ...	97
<i>hookeriana</i> .....	3 288	<i>Clerodendrum</i>	
<i>Eugenia capensis</i> ..	2 404	<i>glabrum</i> .....	86
<i>Cynanchum</i>		<i>Grewia occidentalis</i>	72
<i>ellipticum</i> .....	2 068	<i>Dalbergia obovata</i> .	64



FIG. 4.—Transitional Coast Forest (1c) at Buffalo Pass, East London, in the Cape. Species noted: *Ptaeroxylon obliquum*, *Harpephyllum caffrum*, *Vepris undulata*, *Pittosporum viridiflorum*, *Olea capensis* subsp. *macrocarpa*, *Canthium obovatum*, *Cordia caffra*, *Dalbergia obovata*, *Allophylus decipiens* and *Rhois cissus tomentosa*.



FIG. 5.—Dune Forest (Id) at Port St Johns in Pondoland. Trailing *Ipomoea pes-caprae* in the foreground and *Strelitzia nicolai* behind.

<i>Turraea obtusifolia</i>	1 645	<i>Passerina rigida</i> ...	52
<i>Salacia kraussii</i> ...	1 252	<i>Psidium guajava</i> ...	41
<i>Rhus</i> sp. = A. 13250.....	1 026	<i>Rhoicissus</i> <i>tridentata</i> .....	36
<i>Fagara capensis</i> ...	1 006	<i>Cotyledon</i> <i>orbiculata</i> .....	30
<i>Rhoicissus digitata</i>	849	<i>Clausena anisata</i> ...	7
<i>Putterlickia</i> <i>verrucosa</i> .....	690		

while the less generally occurring shrubs and climbers include:—

<i>Rhynchosia</i> <i>caribaea</i> .....	684	<i>Dovyalis</i> <i>rhamnoidea</i> .....	168
<i>Rhus guenzi</i> .....	506	<i>Allophylus</i> <i>dregeanus</i> .....	156
<i>Flagellaria</i> <i>guineensis</i> .....	488	<i>Bchnia reticulata</i> ...	156
<i>Ipomoea cairica</i> ...	488	<i>Berkheya</i> <i>bipinnatifida</i> .....	156
<i>Pavetta lanceolata</i> ...	471	<i>Pyrenacantha</i> <i>scandens</i> .....	156
<i>Solanum</i> <i>geniculatum</i> .....	471	<i>Veronica angulifolia</i>	156
<i>Asparagus falcatus</i>	470	<i>Ctenomeria</i> <i>capensis</i> .....	151
<i>Cassine tetragona</i>	328	<i>Rhus crenata</i> .....	99
<i>Glycine javanica</i> ...	313	<i>Metalasia muricata</i>	97
<i>Senecio</i> <i>pterophorus</i> ....	313	and many more	
<i>Psychotria capensis</i>	191		
<i>Smilax kraussiana</i> ..	169		

It will be seen that lianas are less important in this forest, which is what one would expect.

Plants of the forest floor and margin include:—

<i>Dactyloctenium</i> <i>australe</i> .....	106 509	<i>Achyranthes aspera</i>	4 275
<i>Ehrharta erecta</i> ...	33 109	<i>Gloriosa superba</i> ...	876
<i>Acanthaceae</i> .....	21 263	<i>Panicum deustum</i> ..	719
<i>Oplismenus</i> <i>hirtellus</i> .....	17 213	<i>Mariscus dregeanus</i>	667
<i>Asystasia gangetica</i>	8 450	<i>Rubia cordifolia</i> ...	94
<i>Commelinaceae</i> .....	6 538	<i>Mariscus sieberanus</i>	
<i>Panicum maximum</i>	6 273	<i>Cissus fragilis</i> .....	55
<i>Pupalia</i> <i>atropurpurea</i> ....	5 797	<i>Kalanchoe</i> <i>rotundifolia</i> .....	27
		<i>Senecio deltoideus</i> .	7

The total number of species in the Relative Abundance Table is 342.

The lower edge of this forest, on the seaward side, usually consists of pioneer stages where the dunes face directly on to the beach:—

(1) *Chrysanthemoidea monilifera*, *Metalasia muri-*  
*cata*, *Passerina rigida* on half stabilized dunes.

(2) *Mariscus congestus*, *Sporobolus virginicus*,  
*Scaevola thunbergii*, *Ipomoea pes-caprae* and other  
trailing and stoloniferous plants, on recently formed  
dunes.

(3) *Gazania rigens* var. *uniflora* *Arctotheca populi-*  
*folia* and *Heteroptilis suffruticosa* at the edge of the  
beach.

Where the coast is rocky, the forest will come right down to high-tide level.

The scrubby thornveld which replaces this dune-forest includes a number of species of Fynbos affinity, e.g. *Stipagrostis zeyheri* subsp. *macropus*, *Ehrharta calycina*, *Ficinia lateralis*, *Restio* sp., *Metalasia muricata* and *Chrysanthemoidea monilifera*, especially southwards and on loose, disturbed sand. On the whole, however, it is sub-tropical, dominated by *Themeda triandra* with much *Digitaria littoralis*. Other important species are:—

<i>Diheteropogon amplexens</i>	<i>Imperata cylindrica</i>
<i>Argyrolobium rupestre</i>	<i>Indigofera</i> spp.
<i>Aristida junciformis</i> (sometimes)	<i>Lasiosiphon anthylloides</i>
<i>Felicia erigeroides</i>	<i>L. maeropetalus</i>
<i>Brachiaria serrata</i> var. <i>serrata</i>	<i>Lobelia scabra</i>
<i>Centella asiatica</i>	<i>Monsonia ovata</i>
<i>Chaetaeanthus setiger</i>	<i>Paspalum orbiculare</i>
<i>Cymbopogon marginatus</i>	<i>Polycarea cuneifolia</i>
<i>Cynodon dactylon</i>	<i>Sacciolepis curvata</i>
<i>Elionurus argenteus</i>	<i>Setaria sphacelata</i>
<i>Eragrostis chloromelas</i>	<i>Sporobolus africanus</i>
<i>Eriosema squarrosum</i>	<i>Stenotaphrum secundatum</i>
<i>Eulalia villosa</i>	<i>Tephrosia macropoda</i>
<i>Helichrysum spp.</i>	<i>Trachypogon spicatus</i>
	<i>Tristachya hispida</i>

The indicators of the Dune-forest are *Minusops caffra* and *Allophylus natalensis*.

#### (e) The Mangrove Forests

The Mangrove Forests have not been studied at all in the course of this survey so far. They are well developed at Durban (Fig. 6) and do not extend much further south, except as temporary patches at the mouths of rivers where suitable mud-flats occur, e.g. at Bashee Mouth. Typical trees are the Mangroves, *Avicennia marina*, *Bruguiera gymnorhiza* and *Rhizophora mucronata*, and *Hibiscus tiliaceus*. (See Marloth II, 2, Fig. 141B; Taljaard, Photo 121.)

## 2 THE ALEXANDRIA FOREST

This is the south-westward extension of the coastal tropical forest into the divisions of Peddie, Bathurst, Alexandria and Port Elizabeth, reaching its best

FIG. 6.—*Avicennia marina*-  
*Bruguiera gymnorhiza* Mangrove Forest (1e) near the mouth of the estuary at Isipingo on the south coast of Natal.



development in Alexandria, where, also, the biggest areas of it survive. The rainfall is smaller (650-750 mm per annum), but is better distributed, a good proportion of it falling in winter. On the other hand, this dispersion through the year of a moderate rainfall makes droughts felt more severely, so that the forest is of a decidedly more xerophytic type than is that to the north-east of the Keiskama River. It links the latter, by easy transitions, with the Addo Bush.

The Alexandria Forest, in general, is a short (10 m), very dense forest; it is said that the best parts of it are high forest, but these have not been seen, and no data about them are available. So far as this survey goes, the principal trees of general occurrence are:—

<i>Ochna arborea</i> ....	785	<i>Harpephyllum</i>
<i>Apodytes dimidiata</i>	664	<i>caffrum</i> ..... 16
<i>Cassine aethiopica</i>	565	<i>Acacia karroo</i> .... 15
<i>Sideroxylon inerme</i>	147	<i>Allophylus</i>
<i>Euclea undulata</i> ....	77	<i>decipiens</i> ..... 14
<i>Olea woodiana</i> ....	68	<i>Euclea schimperi</i>
<i>O. africana</i> ....	52	<i>var. daphnooides</i> .. 11
<i>Linoeciera foveolata</i>	39	<i>Cussonia spicata</i> .... 7
<i>Ptaeroxylon obliquum</i> ....	30	<i>Cassine crocea</i> .... 5
<i>Ficus burtt-davyi</i> ....	26	<i>Hippobromus pauciflorus</i> ..... 5
<i>Scolopia zeyheri</i> ....	17	

#### Trees of less general occurrence are:—

<i>Euclea natalensis</i> ..	472	<i>Cassine peragua</i> ... 14
<i>Pittosporum viridiflorum</i> ....	314	<i>Trichocladus ellipticus</i> ..... 10
<i>Rapanea melanophloeos</i> ...	157	<i>Canthium obovatum</i> ..... 6
<i>Strychnos decussata</i>	156	<i>Curtisia dentata</i> .... 6
<i>Pterocelastrus tricuspidatus</i> ....	144	<i>Olinia cymosa</i> .... 6
<i>Schotia latifolia</i> ....	116	<i>O. emarginata</i> .... 6
<i>Maytenus undata</i> .....	38	<i>Tarchonanthus camphoratus</i> var. <i>camphoratus</i> .... 3
<i>Schotia afra</i> var. <i>africana</i> .....	32	<i>Oricia bachmannii</i> .... 2
<i>Cordia caffra</i> ....	21	<i>Vepris undulata</i> .... 2
<i>Canthium ventosum</i> .....	14	<i>Brachylaena discolor</i> ..... 1

In this short forest, shrubs are particularly important, many of them being scramblers; of general occurrence are:—

<i>Scutia myrtina</i> ....	7 675	<i>Maytenus heterophylla</i> .... 116
<i>Azima tetracantha</i>	5 469	<i>Rhoicissus digitata</i> .... 103
<i>Grewia occidentalis</i>	3 139	<i>Asparagus asparagoides</i> .... 99
<i>Rhoiacarpus capensis</i> .....	3 128	<i>Croton rivularis</i> .... 75
<i>Capparis sepiaria</i> var. <i>citrifolia</i> ....	2 888	<i>Pavonia praemorsa</i> .... 71
<i>Plumbago auriculata</i> ....	2 854	<i>Rhus refracta</i> .... 70
<i>Cynanchum ellipticum</i> ....	2 432	<i>Cotyledon velutina</i> .... 69
<i>Behnia reticulata</i> ....	1 291	<i>Pelargonium peltatum</i> .... 67
<i>Clausena anisata</i> ....	1 269	<i>Ehretia rigida</i> .... 63
<i>Dovyalis rhammoides</i> ....	1 023	<i>Asparagus setaceus</i> .... 40
<i>Fagaria capensis</i> ....	925	<i>Sarcostemma viminale</i> .... 34
<i>Rhoicissus digitata</i>	875	<i>Diospyros lycioides</i> subsp. <i>lycioides</i> .... 26
<i>Rhus longispina</i> ....	818	<i>Tecomaria capensis</i> .... 26
<i>Secamone frutescens</i> ....	818	<i>Rhoicissus tomentosa</i> .... 11
<i>Rhus incisa</i> ....	789	<i>Acokanthera oppositifolia</i> .... 9
<i>Carissa bispinosa</i> ....	787	<i>Capparis fascicularis</i> var. <i>zeyheri</i> .... 7
<i>Canthium spinosum</i>	738	<i>Maerua parvifolia</i> .... 7
<i>Asparagus africanus</i> ....	691	<i>Viscum obscurum</i> .... 6
<i>Diospyros villosa</i> ....	663	<i>Capparis transvaalensis</i> var. <i>calvescens</i> .... 5
<i>Jasminum angulare</i>	627	
<i>Cussonia thyrsiflora</i>	338	
<i>Rhus lucida</i> ....	143	

#### Of less general occurrence are:—

<i>Cassine tetragona</i> ...	489	<i>Clerodendrum glabrum</i> .... 31
<i>Putterlickia pyracantha</i> ....	488	<i>Senecio deltoideus</i> ....
<i>Clematis</i> sp.....	471	<i>Chrysanthemoideas monilifera</i> .... 17
<i>Asparagus racemosus</i> ....	320	<i>Eugenia capensis</i> .... 16
<i>Senecio brachypodus</i> ....	314	<i>Pavetta</i> spp.... 14
<i>Secamone alpini</i> ....	313	<i>Senecio macroglossus</i> .... 14
<i>Rhoicissus tridentata</i> ....	159	<i>Psychotria capensis</i> .... 7
<i>Euclea racemosa</i> ....	156	<i>Allophylus natalensis</i> .... 6
<i>Olea exasperata</i> ....	156	<i>Aloe speciosa</i> .... 6
		<i>Rhamnus prinoides</i> .... 6

and many more.

#### The undergrowth includes:—

<i>Acanthaceae</i> , various	104 310	<i>Euphorbia krausiana</i> ....
<i>Panicum deustum</i> ...	4 875	<i>Exomis microphylla</i> var. <i>microphylla</i> ....
<i>Sansevieria</i> sp....	179	

with the following, and many more, less general:

Plectranthus madagascariensis	740	Panicum maximum	325
Cyperus albostriatus....	471	Achyranthes aspera	156
Stipa dregeana....	471	Asparagus oxyacanthus....	156

The total number of species in the Relative Abundance Table is 259.

This part of the coastal belt is less steeply rolling than that to the north-east, except in the eastern part of the Alexandria division, where the valleys are deep and rocky; here the easy transition from Alexandria Forest to Valley Bushveld is well seen. The broad belt of dunes between the sea and the hills in the Alexandria division provides an interesting transition from the Dune Forest to the Alexandria Forest, but it has still to be studied. Towards Kengelbosch the transition to Addo Bush can be seen; in these drier parts the forest is replaced by a fairly dense *Acacia karoo*-thornveld, whereas in the wetter parts, e.g. west of Port Alfred, it tends to be replaced by an almost pure grassveld. This grassveld is similar to that of the Kei-Keiskama transitional area, but has more species of Fynbos affinity, which, in the sandier parts, are quite important and likely to become more important.

As in the rest of the coastal belt, the soils are stable, and the same remarks about utilization apply. Under the drier conditions, however, the margin of safety is likely to be narrower, so that few liberties can be taken with the soil.

### 3 THE PONDOLAND COASTAL PLATEAU SOURVELD

This veld type occupies a plateau, at an elevation of 300-450 m above the sea, rising steeply from the coast, and deeply broken and indented by forest-filled gorges (Fig. 7). The escarpment is forest-clothed, tropical at the coast, but sub-tropical on the upper slopes and showing an affinity with the Knysna Forest. The Plateau itself is grassveld, very dense and vigorous, but on the Table Mountain sandstone of this plateau, under conditions of high summer rainfall (1 150 to over 1 300 mm per annum), it is very sour. The forests are mainly to be found in protected places—the escarpment, the gorges, and little valleys below krantzes, but are less strictly confined to such places than are the forests of higher altitudes.

It is high forest, differing from the coastal forest mainly in the presence, in an important rôle, of *Podocarpus latifolius*; generally occurring trees are:

Strelitzia Nicolai...	1 213	Podocarpus	
Protorhus longifolia	254	latifolius.....	18
Schefflera umbellifera.....	247	Trichilia emetica	18
Trimeria grandifolia.....	103	Syzygium cordatum	17
Croton sylvaticus...	76	Xymalos	
Ficus burtt-davyi...	76	monospora.....	12
Ilex mitis.....	74	Cussonia spicata...	9
Combretum kraussii.....	57	Ekebergia capensis	9
Syzygium gerrardii	57	Millettia grandis...	9
Trema orientalis...	57	Rothmannia	
Sapium ellipticum..	53	globosa.....	6
Ficus natalensis...	49	Loxostylis alata...	6
Macaranga capensis	23	Cryptocarya woodii	5
Apodytes dimidiata	18	Scopolia zeyheri...	5
Cassipourea gummiflua var. verticillata.....	18	Bersama tysoniana	1
		Canthium	
		mundianum.....	1

Less generally occurring trees are:

Hippobromus pauciflorus.....	400	Fagara davyi.....	6
Brachylaena discolor.....	81	Orcia bachmannii	6
Millettia sutherlandii.....	64	Cassine aethiopica	3
Vepris undulata...	35	Celtis africana.....	3
Nuxia floribunda	32	Cryptocarya latifolia.....	3
Rhus chirindensis forma legatii....	32	Ficus ingens.....	3
Rapanea melanophloeos...	22	Maytenus peduncularis....	3
Chaetacme aristata	16	Halleria lucida.....	3
Ficus capensis....	16	Mimusops obovata	3
Rothmannia capensis.....	16	Pittosporum viridisflorum....	3
		Podocarpus falcatus	3
		Rauvolfia caffra....	3

Generally occurring shrubs and climbers are:

Uvaria caffra.....	7 008	Cissus fragilis.....	57
Smilax kraussiana	6 400	Cnestis natalensis..	57
Dalbergia obovata	4 240	Indigofera	
Flagellaria guineensis.....	4 022	natalensis.....	57
Prosphytoclao prehensilis.....	2 448	Rhoicissus	
Burchellia bubalina	2 281	rhomboidea.....	57
Diospyros villosa..	2 176	Psychotria capensis	49
Secamone alpini...	1 734	Asparagus sp.....	35
Grewia lasiocarpa..	1 612	Behnia reticulata...	30
Cissampelos torulosa.....	1 252	Cryptocarya wyliei.	17
Peddiea africana...	1 252	Rhoicissus	
Dioscorea cotinifolia.....	1 209	tridentata.....	10
Pavetta bowkeri...	1 205	Noltia africana....	1
Cassinopsis tinifolia	125	Diospyros scabrida	
Ctenomeria capensis.....	100	var. cordata.....	5
Clerodendron glabrum.....	72	Rhus lucida.....	3
		Chrysanthemoides	
		monilifera.....	1
		Crotalaria capensis	1

Less generally occurring shrubs and climbers include:

Entada spicata.....	803	Solanum	
Rubus sp.....	803	mauritianum....	83
Carissa bispinosa...	800	Rhoicissus	
Helinus		tomentosa.....	81
integrifolius.....	400	Dracaena	
Tecomaria capensis	400	hookeriana.....	64
Sphaerostylis natalensis.....	400	Acacia ataxacantha	40
Tricalysia lanceolata.....	400	Hippocratea sp....	40
Allophylus dregeanus.....	129	Adenia gummifera	35
		Dioseorea dregeana	35
		Grewia occidentalis	35
		Ceropegia implicata	23

and many more.

Of general occurrence in the undergrowth of the forest-floor and margin are:

Acanthaceae (various).....	28 880	Aneilema	
Lobelia patula.....	13 922	aequinoctiale....	40
Cyperus albostriatus....	4 365	Viscum nervosum..	9
Setaria chevalieri...	947	Senecio	
Clutia pulchella...	121	rhyncholaenus...	8

with the following of less general occurrence:

Oplismenus hirtellus.....	31 680	Panicum	
Plectranthus ciliatus	1 440	chusqueoides....	144
Glycine javanica...	803	Sporobolus subtilis.	144
Dactyloctenium australe.....	334	Panicum maximum	126
Blechnum australe.	289	Ischaemum	
Commelinia benghalensis....	230	arcuatum.....	75
		Acianthus	
		parvifolius.....	67

The total number of species in the Relative Abundance Table is 351.



FIG. 7.—Ngagwana Gorge Forest, part of Pondoland Coastal Plateau Sourveld (3), east of Lusikisiki in Pondoland. Species noted: *Milletia grandis*, *Schefflera umbellifera*, *Croton sylvaticus*, *Combretum kraussii*, *Nuxia floribunda*, *Macaranga capensis*, *Trichilia emetica* and *Protorhus longifolia*.

The Pondoland Plateau Sourveld itself is the densest veld in the Republic, so dense that the grasses grow as single shoots rather than as tufts; at least the tufts are very small. The species of general occurrence are:—

<i>Themeda triandra</i> ..	729 673	<i>Desmodium</i>	
<i>Tristachya hispida</i> . 720 000		<i>caffrum</i> .....	1 670
<i>Diheteropogon</i>		<i>Dierama reynoldsii</i>	1 670
<i>filifolius</i> .....	489 600	<i>Thunbergia</i>	
<i>Trachypogon</i>		<i>atriplicifolia</i> .....	1 556
<i>spicatus</i> .....	439 200	<i>Cymbopogon</i>	
<i>Diheteropogon</i>		<i>validus</i> .....	1 443
<i>amplectens</i> .....	380 867	<i>Fadogia</i> sp.....	1 163
<i>Monocymbium</i>		<i>Anthospermum</i> sp.	
<i>ceresiiforme</i> .....	121 111	= A. 10677.....	1 160
<i>Eulalia villosa</i> .....	103 973	<i>Helichrysum</i>	
<i>Cyperus</i>		<i>adscedens</i> .....	870
<i>obtusiflorus</i> var.		<i>Panicum natalense</i>	839
<i>obtusiflorus</i> .....	102 833	<i>Setaria sphacelata</i> ..	839
<i>Heteropogon</i>		<i>Gnidia kraussiana</i> ..	837
<i>contortus</i> .....	86 422	<i>Watsonia densiflora</i>	837
<i>Eragrostis racemosa</i>	60 833	<i>Cyphella elata</i> .....	834
<i>Alloteropsis</i>		<i>Diodia natalensis</i> ..	97
<i>semialata</i> .....	47 556	<i>Panicum aequinerve</i>	72
<i>Eragrostis capensis</i> .	41 119	<i>Centella glabrata</i>	
<i>Aristida junciformis</i>	19 919	var. <i>natalensis</i> ....	70
<i>Loudetia simplex</i> ...	19 204	<i>C. asiatica</i> .....	41
<i>Acalypha</i>		<i>Euphorbia</i>	
<i>peduncularis</i> ....	9 733	<i>epicryparissias</i> ....	40
<i>Digitaria diagonalis</i>	9 733	<i>Hybanthus</i>	
<i>Paspalum</i>		<i>enneaspermus</i> ....	39
<i>orbiculare</i> .....	8 082	<i>Ctenium</i>	
<i>Restio</i> sp.....	4 800	<i>concinnum</i> .....	12
<i>Pentanisia</i>		<i>Muraltia stipulacea</i>	5
<i>prunelloides</i> ....	4 713	<i>Helophilus</i>	
<i>Tephrosia</i>		<i>rigidiuscula</i> .....	3
<i>macropoda</i> .....	4 278	<i>Osteospermum</i>	
<i>Rhynchosia totta</i> ..	3 418	<i>imbricatum</i> sub-	
<i>Scilla nervosa</i> .....	3 378	sp. <i>nervatum</i> .....	1
<i>Digitaria</i> sp.....	3 000	<i>Rhus discolor</i> .....	1
<i>Helichrysum</i>			
<i>appendiculatum</i> ..	1 924		

Of less general occurrence are:—

<i>Cassia mimosoides</i> ..	24 825	<i>Indigofera</i> <i>hilaris</i> ..	1 111
<i>Schoenoxiphium</i> sp.	3 756	<i>Eugenia albanensis</i>	611
<i>Ficinia</i> sp. ....	1 600	<i>Panicum</i>	
<i>Eriosema</i>		<i>dregeanum</i> .....	563
<i>squarrosum</i> ....	1 160	<i>Xyris anceps</i> .....	559
<i>Bicum obovatum</i> ..	1 111	<i>Acalypha schinzii</i> ..	558
<i>Berkheya</i>		<i>Hypoxis rigidula</i> ...	558
<i>bipinnatifida</i> ....	1 111	<i>Indigofera rostrata</i> .	558

and many more, the total number of species in the Relative Abundance Table being 211.

This is a particularly well-mixed veld, with no one species overwhelmingly dominant, but very sour. Most of it seems to be scarcely grazed at all, probably owing to its sourness; where it is grazed, it tends to become dominated by, and largely replaced by, *Aristida junciformis*.

The regular occurrence of *Podocarpus*, *Loxostylis*, *Restio*, *Muraltia*, *Noltia*, *Rhus lucida*, *Chrysanthemoides* and *Centella glabrata* var. *natalensis* is interesting, as showing a link with the Fynbos and the Knysna Forest; further, among the rarer plants occur also *Leucadendron eucalyptifolium*, *Lobelia coronopifolia*, *Roella glomerata*, *Protea multibracteata*, *Gnidia myrtifolia*, *Aspalathus loricifolia*, *A. setacea*, *Stoebe vulgaris*, *Agathosma ovata*, *Festuca costata*, *Protea caffra*, *P. roupelliae*, *Relhania pungens*, *Schizaea tenella*, *Athanasia leucoclada*, *Cliffortia strobilifera*, *Philippia evansii* and *Phyllica paniculata*, all of Fynbos affinity. On the other hand, in *Loudetia simplex*, *Ctenium concinnum* and *Schizachyrium sanguineum* we have an interesting link with the high altitude sour grassveld types of the Transvaal.

The indicators of this veld type are *Podocarpus latifolius* in association with *Protorhus*, *Schefflera umbellifera*, *Croton sylvaticus* and *Macaranga*.

Outliers occur on The Heads at Port St John's; here the fynbos elements are particularly conspicuous.

The Pondoland Plateau Sourveld could be one of the most productive parts of the Republic; at present its potentialities are completely wasted. The stages in the reversed succession have not been established in detail, but appear to be of the usual type:—

- (1) High Forest (the climax)
- (2) Short Forest
- (3) Scrubby, tall, sour grassveld
- (4) Short sour grassveld (the optimum stage)
- (5) 'Ngongoni Veld (the critical, and lowest, stage).

#### 4 THE KNYSNA FOREST

(See Marloth I, Pl. 13; III, 1, Pl. 19, 30; Adamson, Photo 4)

This forest has been little studied during this survey, because it has already been exhaustively described by J. F. V. Phillips, Forest Succession and

Ecology in the Knysna Region, Memoir of the Botanical Survey of South Africa No. 14 (1931). It should be pointed out, however, that it is probable that the importance of the Fynbos in the succession to forest is largely (though not entirely) the result of careless exploitation; that the agriculturally useful sub-tropical grassveld would have been far more important under conditions of wise and knowledgeable exploitation than the agriculturally useless Fynbos is to-day. This region of high, well distributed rainfall, sour sandy soils and vigorous vegetating is, like the Pondoland Plateau, one whose agricultural potentialities have scarcely been touched (Fig. 8).

## 5 THE 'NGONGONI VELD

(See Taljaard, Photos 114, 118; King, Figs. 11, 190)

This veld type, together with the Eastern Province Thornveld and the Zululand Thornveld, occupies a narrow and irregular belt of rolling country just above the Coastal Forest belt. It lies on the slopes of the escarpment of the lowest of the series of plateaux of which South Africa is made up, and, lying between c.450 and 900 m above the sea, is a good deal cooler and less humid than the coast-belt. The rainfall ranges from 750 to 1 300 mm per annum, and the natural vegetation would have been forest and scrub-forest of tropical affinity, but lacking, as important constituents, the species of more essentially tropical nature. At lower levels it is, like the coast-belt, intersected by numerous bush-filled river valleys, itself occupying the ridges, but at the higher levels it tends to occupy the valleys, at least of the shorter rivers, the Highland Sourveld, Dohne

Sourveld and Natal Mistbelt 'Ngongoni veld occupying the ridges. What chiefly distinguishes it from the Zululand Thornveld to the north and the Eastern Province Thornveld to the south-west is the fact that the sour grassveld, which has almost completely replaced the forest, has become dominated by the 'Ngongoni (*Aristida junciformis*), almost to the exclusion of other grasses. Why this should be so is not at all clear, particularly as this grass is able to grow in the latter veld types. The only other place where the 'Ngongoni has been observed to become similarly dominant is a few square kilometres around Swellendam.

The surviving forests include the important Nkandla (Fig. 9), Qudenai and Weza forests, all near the upper edge of the veld type, except that the Qudenai forest extends down into the Tugela valley to about 450 m. The lower part of the forest, however, was not included in the sample. It must not be thought that this veld has become treeless; on the contrary, exotic wattles have been extensively planted.

The trees of general occurrence in the forests of the 'Ngongoni veld are:—

Trimeria		Harpephyllum
grandifolia.....	1 356	caffrum.....
Combretem		Kiggelaria africana
kraussii.....	1 277	Pittosporum
Rapanea		viridiflorum.....
melanophloeos...	981	Rhus chirindensis
Cryptocarya woodii	496	forma legatii....
Xymalos		Bersama tysoniana
monospora.....	217	Celtis africana....
Halleria lucida....	65	Calodendrum
Cussonia spicata...	25	capense.....



FIG. 8.—The Gouna Forest, part of the Knysna Forest (4) in the southern Cape. Species present: *Olea capensis* subsp. *macrocarpa*, *Podocarpus falcatus*, *P. latifolius*, *Ocotea bullata*, *Apodytes dimidiata*, *Faurea macnaughtonii* and *Curtisia dentata*.



FIG. 9.—The Nkandla Forests and subclimax grassveld in 'Ngongoni Veld (5) in Natal. Species noted: *Syzygium gerrardii*, *Xymalos monospora*, *Combretum kraussii*, *Cryptocarya woodii*, *Olea capensis* subsp. *macrocarpa*, *Vepris undulata* Schefflera *umbellifera*, *Cassipourea Gunniflora* var. *verticillata*, *Rhoicissus rhomboidea*, *Mackaya bella*, *Strophanthus speciosus*, *Uvaria caffra*, *Buddleia dysophylla* and *Oplismenus hirtellus*.

#### Trees of less general occurrence are:—

<i>Apodytes dimidiata</i>	310	<i>Rothmannia</i>	
<i>Syzygium cordatum</i>	92	<i>globosa</i> .....	7
<i>Scolopia flanaganii</i>	51	<i>Scolopia zeyheri</i> ....	7
<i>Garcinia gerrardii</i> ..	44	<i>Cunonia capensis</i> ..	6
<i>Syzygium gerrardii</i>	29	<i>Ocotea bullata</i> ....	4
<i>Olea capensis</i> subsp.		<i>Oricia bachmannii</i> .	4
<i>macrocarpa</i> .....	17	<i>Schefflera</i> <i>umbellifera</i> .....	4
<i>Scolopia mundii</i> ....	17	<i>Seemannaralia</i>	
<i>Vepris undulata</i> ....	17	<i>gerrardii</i> .....	4
<i>Trichocladus</i> <i>ellipticus</i> .....	16	<i>Trichilia emetica</i> ....	4
<i>Podocarpus</i> <i>latifolius</i> .....	13	<i>Fagara davyi</i> .....	4
<i>Allophylus</i> <i>decipiens</i> .....	7	<i>Rothmannia</i> <i>capensis</i> .....	3
		<i>Olea woodiana</i> ....	3

and many more, including as rarities *Macaranga*, *Ficus natalensis*, *Protorhus*, *Trema*, *Albizia adianthifolia*, *Casearia gladiiformis* and *Croton sylvaticus* amongst the tropical species, and *Podocarpus falcatus* and *P. henkelii* amongst the southern species.

#### Generally occurring shrubs and climbers are:—

<i>Uvaria caffra</i> .....	3 604	<i>Rubus</i> sp.....	403
<i>Andrachne ovalis</i> ..	3 529	<i>Burchellia bubalina</i>	81
<i>Senecio deltoideus</i> .	2 816	<i>Senecio</i>	
<i>panduraefolius</i> ...		<i>panduraefolius</i> ...	76
<i>torulosa</i> .....	2 319	<i>Scutia myrtina</i> ....	73
<i>Maytenus</i>		<i>Cassinella tetragona</i> ..	69
<i>mossambicensis</i> ..	2 183	<i>Secamone alpini</i> ....	61
<i>Clausena anisata</i> ...	1 466	<i>Entada spicata</i> ....	39
<i>Canthium ciliatum</i> .	1 326	<i>Grewia lasiocarpa</i> ..	32
<i>Strophanthus</i> <i>speciosus</i> .....	1 230	<i>Helinus</i> <i>integrifolius</i> ....	28
<i>Dalbergia obovata</i>	1 084	<i>Calpurnia aurea</i>	
<i>subsp. sylvatica</i> ..		<i>subsp. sylvatica</i> ..	21
<i>Behnia reticulata</i> ...	963	<i>Psychotria capensis</i>	21
<i>Vernonia</i> <i>mespilifolia</i> .....	836	<i>Rhoicissus</i>	
<i>tomentosata</i> ....		<i>tomentosata</i> ....	21
<i>Allophylus</i> <i>dregeanus</i> .....	747	<i>Carissa spinosa</i> ...	9
<i>Dioscorea dregeana</i>	733	<i>Osyridocarpus</i>	
<i>schimperianus</i> ...		<i>schimperianus</i> ...	7
<i>Rhoicissus</i> <i>rhomboidea</i> ....	720	<i>Maytenus</i>	
<i>Rubus</i> sp.....	568	<i>heterophylla</i> ....	6
<i>Rhoicissus</i> <i>tridentata</i> .....	504	<i>Cassinopsis tinifolia</i>	5
<i>Grewia occidentalis</i>	501	<i>Heteromorpha</i>	
		<i>arborescens</i> .....	5

Less generally occurring shrubs and climbers include:—

<i>Peddiea africana</i> ...	973	<i>Dalbergia multijuga</i>	113
<i>Stephanja</i> <i>abyssinica</i> var. <i>tomentella</i> .....	888	<i>Maytenus</i> <i>nemorosa</i> .....	106
<i>Pavetta kotzei</i> ....	531	<i>Buddleia pulchella</i>	102
<i>Senecio tamoides</i> ...	531	<i>Rinorea</i> <i>angustifolia</i> ....	102
<i>Jasminum</i> <i>stenolobum</i> .....	417	<i>Riocreuxia torulosa</i>	102
		<i>Smilax kraussiana</i>	102

<i>Asparagus setaceus</i>	323	<i>Tecomaria capensis</i>	102
<i>Diospyros villosa</i> ..	323	<i>Oxyanthus gerrardii</i>	53
<i>Dovyalis</i>		<i>Pavetta bowkeri</i> ....	53
<i>rhamnoidea</i> .....	320	<i>Cnestis natalensis</i> ...	51
<i>Maesa lanceolata</i> ..	287	<i>Flagellaria</i>	
<i>Buddleia dysophylla</i>	282	<i>guineensis</i> .....	51
<i>Clematis brachiata</i> ..	277	<i>Maytenus</i>	
<i>Tricalysia</i> <i>lanceolata</i> .....	259	<i>acuminata</i> .....	51
<i>Senecio</i> <i>mikanoides</i> .....	213	<i>Maytenus</i>	
<i>Mackaya bella</i> ....	204	<i>mossambicensis</i> var. <i>ruber</i> .....	51
<i>Euclea natalensis</i> ..	154	<i>Maesa alnifolia</i> ....	49

Generally occurring plants of the forest-floor and margin are:—

<i>Hypoestes</i>		<i>Pteris catoptera</i> ....	1 052
<i>verticillaris</i> and other		<i>Pteridium</i>	
<i>Acanthaceae</i> ....	61 776	<i>aquilinum</i> .....	621
<i>Oplismenus</i> <i>hirtellus</i> .....	53 200	<i>Misanthidium</i> <i>capense</i> .....	569
<i>Plectranthus</i>		<i>Blechnum</i>	
<i>laxiflorus</i> .....	30 427	<i>attenuatum</i> .....	368
<i>Cyperus</i> <i>albostriatus</i> ....	6 405	<i>Rubia cordifolia</i> ....	33
<i>Galopina</i> <i>circaeoides</i> .....	4 224	<i>Helichrysum</i> <i>nudifolium</i> var. <i>quinquenerve</i> ....	31
<i>Selaginella</i> <i>kraussiana</i> .....	4 145	<i>Schistostephium</i> <i>rotundifolium</i> ....	31
<i>Pellaea viridis</i> ....	4 042		

while the following, and many others, are of less general occurrence:—

<i>Prosphytochloa</i>		<i>validus</i> .....	646
<i>prehensilis</i> .....	11 164	<i>Streptocarpus rexii</i> .	598
<i>Setaria chevalieri</i> ...	10 277	<i>Euphorbia</i>	
<i>Panicum aequinerve</i>	2 645	<i>kraussiana</i> .....	514
<i>Ehrharta erecta</i> ....	2 497	<i>Polystichum</i>	
<i>Centella asiatica</i> ...	1 734	<i>luctuosum</i> .....	512
<i>Cheilanthes</i> <i>bergiana</i> .....	1 592	<i>Polypodium</i> <i>polypodioides</i> ...:	404
<i>Plectranthus</i> <i>ecklonii</i> .....	1 236	<i>Mohria caffrorum</i> ..	388
<i>Osteospermum</i>		<i>Asplenium</i>	
<i>herbaceum</i> ....		<i>adiantum-nigrum</i>	320
<i>O. grandidentatum</i> .....	1 185	<i>Asparagus virgatus</i>	268
<i>Laportea</i>		<i>Nidorella auriculata</i>	109
<i>peduncularis</i> ....	906	<i>Conostomium</i>	
<i>Plectranthus ciliatus</i>	735	<i>natalense</i> .....	95
<i>Asplenium</i>		<i>Clutia pulchella</i> ...	78
<i>aethiopicum</i> ....	661	<i>C. hirsuta</i> .....	66
<i>Anthospermum</i>		<i>Leonotis leonurus</i> ..	41
<i>herbaceum</i> ....	654	<i>Cyphostemma</i> <i>woodii</i> .....	7
		<i>Athrixia phyllocoidea</i>	4

The ferns are of greater importance here than in the Coastal Forest, and include the tree-ferns *Alsophila dregei* 1, *Alsophila capensis* 5, *Blotiella glabra*

5 and *Marattia fraxinea* 5; while the palms and *Strelitzia* have fallen out and *Dracaena* 12 has become rare.

The indicators of this forest are *Combretum kraussii* as dominant with *Trimeria grandifolia*, *Rapanea*, *Cryptocarya woodii* and *Xynalos monospora*.

The number of species in the Relative Abundance Table is 446.

Although selected samples of the thornveld which replaces this forest show it to be a well-mixed *Themeda*-dominated sourveld, it must be remembered that, to-day, by far the greater part of the area is completely dominated by *Aristida junciformis*, for which reason it has been named the 'Ngongoni Veld. This thornveld is generally very open, except at the edges of the bush-filled valleys.

Generally occurring species in well preserved samples are:—

<i>Themeda triandra</i> ...	1170 000
<i>Tristachya hispida</i> ...	310 091
<i>Heteropogon contortus</i> ...	241 650
<i>Trachypogon spicatus</i> ...	143 325
<i>Biheteropogon amplectens</i> ...	132 913
<i>Eragrostis plana</i> ...	46 105
<i>E. racemosa</i> ...	38 688
<i>Aristida junciformis</i> ...	29 717
<i>Monocymbium ceresiiforme</i> ...	23 015
<i>Alloteropsis semialata</i> ...	14 839
<i>Sporobolus africanus</i> ...	11 739
<i>Eulalia villosa</i> ...	8 675
<i>Eragrostis capensis</i> ...	8 450
<i>Hypparrhenia hirta</i> ...	8 015
<i>Diodia natalensis</i> ...	6 143
<i>Paspalum orbiculare</i> ...	4 502
<i>Eragrostis curvula</i> ...	3 965
<i>Pentanisia prunelloides</i> ...	2 406
<i>Tephrosia macropoda</i> ...	1 991
<i>Eriosema squarrosum</i> ...	1 900
<i>Acalypha peduncularis</i> ...	1 656
<i>Cassia mimosoides</i> ...	1 628
<i>Aster bakeranus</i> ...	1 599
<i>Vernonia natalensis</i> ...	1 277
<i>Andropogon schirensis</i> ...	1 255
<i>Zornia milneana</i> ...	849
<i>Digitaria diagonalis</i> ...	821
<i>Berkheya setifera</i> ...	677
<i>Thunbergia atriplicifolia</i> ...	677
<i>Centella asiatica</i> ...	454
<i>Cymbopogon validus</i> ...	300
<i>Indigofera rostrata</i> ...	77
<i>Kohautia amatymbica</i> ...	17
<i>Gladiolus ecklonii</i> ...	7
<i>Cephalaria attenuata</i> ...	5

while the following are of less general occurrence:—

<i>Andropogon appendiculatus</i> ...	6 961
<i>Indigofera hilaris</i> ...	3 170
<i>Setaria sphacelata</i> ...	2 703
<i>Diheteropogon filifolius</i> ...	2 112
<i>Brachiaria serrata v. serrata</i> ...	2 112
<i>Microchloa caffra</i> ...	1 801
<i>Bicum obovatum</i> ...	939
<i>Euphorbia striata</i> ...	938
<i>Panicum aequiverve</i> ...	938
<i>Pteridium aquilinum</i> ...	739
<i>Acalypha schinzii</i> ...	489
<i>Rhynchosia adenodes</i> ...	489
<i>R. totta</i> ...	489
<i>Adhatoda andromeda</i> ...	471
<i>Harpochloa falx</i> ...	471
<i>Misanthidium capense</i> ...	270
<i>Watsonia densiflora</i> ...	68
<i>Crabbea hirsuta</i> ...	41
<i>Alysicarpus rugosus</i> ...	21
<i>Commelinia africana</i> ...	21
<i>Cymbopogon excavatus</i> ...	21
<i>Hypericum aethiopicum</i> ...	21
<i>Vigna nervosa</i> ...	21
<i>Conostomium natalense</i> ...	20
<i>Sebaea sedoides</i> var. <i>schoenlandii</i> ...	5
<i>Sonchus dregeanus</i> ...	3
<i>Anthospermum rigidum</i> ...	2
<i>Pellaea viridis</i> ...	2
<i>Polygala hottentota</i> ...	2

and many more, the total number of species in the Relative Abundance Table being 257.

This veld type, with its fairly good rainfall, is also capable of intensification in part; but on the poorer soils in Natal, Pentz considers it to be suitable only for semi-intensive farming. Growth is not so vigorous that the critical stage cannot be passed, as is evidenced by the soil erosion in certain parts, e.g. Nkandla, Ndwedwe and Umzimkulu.

## 6 ZULULAND THORNVELD

Like the 'Ngongoni Veld, this veld type occupies the escarpment of the first plateau, as well as the top and upper east slopes of the Lebombo Range, and although the rainfall is somewhat less (650-1 000 mm per annum, mostly 750-900 mm) it was probably also forest and scrub-forest in its original condition. It shows a strong bushveld affinity and is to be regarded as a transition from the 'Ngongoni Veld to the Lowveld Sour Bushveld and Lowveld.

The Zululand Thornveld has a greater altitudinal range, from about 150 to about 1 050 m above the sea, so that it is easy to recognize two forms of it:—

(a) The low-altitude form, up to about 450 m, which, besides having a hotter climate, is generally somewhat drier.

(b) The high-altitude form.

It is Form (b) which corresponds to the 'Ngongoni Veld, Form (a) corresponding rather to the upper part of the coastal belt further south, but differing in that it is to-day for the most part bushveld rather than thornveld.

Form (a).—(See Reynolds, Pl. 76.) The original forest is of distinctly tropical type with such species as:—

<i>Rauvolfia caffra</i>	<i>Sapium ellipticum</i>
<i>Protorhus longifolia</i>	<i>Entada spicata</i>
<i>Trichilia emetica</i>	<i>Salacia gerrardii</i>
<i>Combretum kraussii</i>	<i>Maesa lanceolata</i>
<i>Macaranga capensis</i>	<i>Strelitzia sp.</i>
<i>Croton sylvaticus</i>	<i>Dalbergia armata</i>
<i>Ekebergia capensis</i>	<i>D. multifluga</i>
<i>Schefflera umbellifera</i>	<i>D. obovata</i>
<i>Albizia adianthifolia</i>	<i>Acacia ataxacantha</i>
<i>Pygeum africanum</i>	<i>Clerodendrum glabrum</i>
<i>Trema orientalis</i>	<i>Flagellaria guineensis</i>
<i>Ficus capensis</i>	<i>Dracaena hookeriana</i>
<i>F. natalensis</i>	<i>Turraea floribunda</i>
<i>F. sycomorus</i>	<i>Sideroxylon inerme</i>
<i>Erythrina caffra</i>	<i>Heteropyxis natalensis</i>
<i>Syzygium cordatum</i>	<i>Spirostachys africana</i>
<i>S. gerrardii</i>	<i>Sclerocarya caffra</i>
<i>Phoenix reclinata</i>	<i>Combretum molle</i>
<i>Hyphaene natalensis</i>	<i>Tarchonanthus galpinii</i>
<i>Uvaria caffra</i>	<i>Iboza riparia</i>

In precipitous situations, *Aloe bainesii*, *Urera tenax*, *Ficus sonderi*, *Cussonia natalensis*, *Euphorbia ingens*, *E. evansii*, *E. triangularis* and *E. tirucalli* also occur.

This forest tends to persist along streams as narrow belts, *Rauvolfia caffra*, *Ficus sycomorus* and *Phoenix reclinata* being the most conspicuous trees. Patches of complete forest are scarce except against the hills towards the upper boundary. In the more or less open bushveld which replaces it, a tall form of *Themeda triandra* is regularly the dominant grass, with abundance of *Panicum maximum* under the trees; and, although thorntrees are the most common (*Acacia nilotica* subsp. *kraussiana*, *A. karroo*, *A. caffra*, *A. gerrardii* var. *gerrardii*, *A. robusta* subsp. *robusta*, *A. sieberana* var. *woodii*, *A. albida* and *A. tortilis* subsp. *heteracantha*) there are large numbers of species of other trees and shrubs, e.g.:—

<i>Euphorbia ingens</i>	<i>Ficus capensis</i>
<i>Sclerocarya caffra</i>	<i>Euclea natalensis</i>
<i>Albizia versicolor</i>	<i>Securinega virosa</i>
<i>Dichrostachys cinerea</i> subsp. <i>africana</i>	<i>Endostemon obtusifolius</i>
<i>Maytenus senegalensis</i>	<i>Ricinus communis</i>
<i>Cussonia spicata</i>	<i>Garcinia livingstonei</i>
<i>Spirostachys africana</i>	<i>Capparis tomentosa</i>
<i>Vangueria infausta</i>	<i>Diösypros galpinii</i>
<i>V. cyanescens</i> (Lebombo)	<i>Erythrina latissima</i>
<i>Dombeya rotundifolia</i>	<i>Salacia kraussii</i>

*Ziziphus mucronata*  
*Sideroxylon inerme*  
*Schotia latifolia*  
*Dovyalis caffra*  
*Phoenix reclinata*  
*Hyphaene natalense*  
*Clerodendrum glabrum*  
*Ficus stuhlmannii*

*Portulacaria afra*  
*Pappea capensis*  
*Heeria spp.*  
*Peltophorum africanum*  
*Bauhinia galpinii*  
*Cussonia natalensis*  
*Ehretia rigida*

This bushveld is generally thicker at the lower altitudes than at higher altitudes; but there are parts where it has been thinned out to thornveld, mainly *Acacia nilotica* subsp. *kraussiana* and *A. caffra*. The grasses are mainly:—

<i>Themeda triandra</i>	<i>Eulalia villosa</i>
<i>Tristachya hispida</i>	<i>Brachiaria serrata</i> var. serrata
<i>Hyperthelia dissoluta</i> and others	<i>Eragrostis racemosa</i>
<i>Cymbopogon excavatus</i>	<i>E. capensis</i>
<i>C. validus</i>	<i>Diheteropogon amplectens</i>
<i>Trachypogon spicatus</i>	<i>Alloteropogon semialata</i>
<i>Chloris gayana</i>	<i>Bothriochloa glabra</i>
<i>Setaria perberbis</i>	<i>Panicum deustum</i>
<i>Panicum maximum</i>	<i>Eriochloa meyeriana</i>

with great variety and abundance of forbs. It is thus of a sourish mixed nature. *Phoenix reclinata* and *Stangeria eriopus* sometimes occur scattered in the open thornveld.

Form (b) of the Zululand Thornveld occupies the higher ridges. It is a more open type of veld with patches of short forest and scrub persisting. No well developed forest has been seen, but the relics which have been examined include such species as:—

<i>Turraea floribunda</i>	<i>Strelitzia sp.</i>
<i>Tricalysia lanceolata</i>	<i>Xeromphis rufid</i>
<i>Commiphora zanzibarica</i>	<i>Maytenus peduncularis</i>
<i>C. harveyi</i>	<i>Ficus sycomorus</i>
<i>Rapanea melanophloeos</i>	<i>F. natalensis</i>
<i>Apodytes dimidiata</i>	<i>Olea africana</i>
<i>Ekebergia capensis</i>	<i>Maytenus senegalensis</i>
<i>Syzygium cordatum</i>	<i>Combretum molle</i>
<i>Trichilia emetica</i>	<i>Euclea natalensis</i>
<i>Clerodendrum glabrum</i>	<i>Cadaba natalensis</i>
<i>Cassine spp.</i>	<i>Azima tetracantha</i>
<i>Acacia sieberana</i> var. woodii	<i>Schotia latifolia</i>
<i>Rauvolfia caffra</i>	<i>Acacia davyi</i>
<i>Cussonia spicata</i>	<i>Premna mooiensis</i>
<i>Grewia occidentalis</i>	<i>Maerua parvifolia</i>
<i>Dichrostachys cinerea</i> subsp. <i>africana</i>	<i>Rhoicissus tridentata</i>
	<i>Clausena anisata</i>
	<i>Psychotria capensis</i>

i.e. sub-tropical and generally of rather a dry type, in a sour grassveld of sub-tropical type, but including as a characteristic species a huge tufted *Eragrostis* sp. in considerable quantity. This grass is prominent on the top of the Lebombo Range, too; here the bushveld and forest of Form (a), and the scrub-forest, bush-clump veld and open thornveld of Form (b) can all be seen within the space of a few kilometres. Here the following grasses have been noted:—

<i>Themeda triandra</i> ... Ab	<i>Diheteropogon</i>
<i>Eragrostis racemosa</i> ... ab	<i>amplectens</i> ..... F
<i>Tristachya hispida</i> ... C	<i>Eulalia villosa</i> ..... f
<i>Trachypogon spicatus</i> C	<i>Rhynchoslytrum</i>
<i>Heteropogon</i> <i>contortus</i> ..... C	<i>repens</i> ..... f
<i>Elionurus argenteus</i> .. c	<i>Eragrostis</i> sp.
<i>Schizachyrium</i> <i>sanguineum</i> ..... C	(huge-tufted)..... lf
<i>Eragrostis capensis</i> ... c	<i>Rhynchoslytrum</i>
<i>Brachiaria serrata</i> var. serrata..... c	<i>setifolium</i> ..... ff
<i>Hyparrhenia</i> <i>poecilothrix</i> ..... 1Ab	<i>Aristida congesta</i>
	<i>subsp. barbicollis</i> .. ff
	<i>Cymbopogon</i>
	<i>excavatus</i> ..... o
	<i>Eragrostis</i>
	<i>chloromelas</i> ..... o
	<i>Diplachne biflora</i> .... o

i.e. a dense and strongly sour veld. It has the wealth of forbs usual in the warmer sub-tropical grassveld types. Under excessive grazing pressure it breaks down into *Digitaria swazilandensis* and *Cynodon dactylon*.

This veld type is valuable cattle country, to which the type of semi-intensive farming system being worked out at Rietvlei Research Station could be applied; but much of it is unusable because of nagana.

## 7 THE EASTERN PROVINCE THORNVELD

This veld type corresponds to the 'Ngongoni veld, but is less sharply differentiated from the coastal belt, especially south-westwards, because in these somewhat drier and more southerly regions, the coast belt is not so markedly luxuriant and evergreen.

Although the climax would have been short forest and scrub-forest, this veld is to-day essentially thornveld, with few species besides *Acacia karroo*, sometimes none at all (Fig. 10). It is sometimes so open as to be practically grassveld, e.g. around King William's Town. Forest relics are rare and tend to occur as narrow belts along streams. North of the Great Kei River the topography is steeply rolling, but south of that river it is flatter. Rainfall ranges from under 500 to 900 mm, mainly 600-750 mm per annum.

Two main variations can be distinguished:—

(a) The northern, or typical form;

(b) the southern form, south of the Great Fish River, in which elements of the Fynbos are more or less important. In this southern part, the rainfall is rather more evenly distributed through the year. The forests in either case differ little from those of the 'Ngongoni Veld, apart from lacking the more strictly tropical trees.

In Form (a), the typical form, the grass is dense and of sourish mixed type, with such grasses as:—

<i>Themeda triandra</i>	<i>Digitaria littoralis</i>
<i>Tristachya hispida</i>	<i>D. diagonalis</i>
<i>Diheteropogon amplectens</i>	<i>Cymbopogon marginatus</i>
<i>Heteropogon contortus</i>	<i>C. excavatus</i>
<i>Elionurus argenteus</i>	<i>Trachypogon spicatus</i>
<i>Eragrostis capensis</i>	<i>Helictotrichon hirtulum</i>
<i>Brachiaria serrata</i> var. serrata	<i>Eragrostis plana</i>
<i>Sporobolus africanus</i>	<i>Eulalia villosa</i>
	<i>Eustachys mutica</i>

with patches of *Hyparrhenia hirta* and a great variety of forbs, e.g.:—

<i>Cassia mimosoides</i>	<i>Indigofera hedyantha</i>
<i>Ficinia</i> spp.	<i>I. hilaris</i>
<i>Cyperus obtusiflorus</i> var. obtusiflorus	<i>I. poliotis</i>
	<i>Aristea cognata</i>
<i>Schistostephium</i>	<i>Lobelia erinus</i> var. bellidifolia
<i>crataegifolium</i>	<i>Helichrysum odoratissimum</i>
<i>Eriosema kraussianum</i>	<i>H. miconiae</i> folium and others
<i>E. squarrosum</i>	<i>Scabiosa columbaria</i>
<i>Senecio retrorsus</i>	<i>Linum thunbergii</i>
<i>S. speciosus</i>	<i>Conostomium natalense</i>
<i>S. bupleuroides</i> and others	<i>Watsonia meriana</i>
<i>Tephrosia macropoda</i>	<i>Acalypha peduncularis</i>
<i>Thunbergia capensis</i>	
<i>Monsonia ovata</i>	

Fynbos influence is seen in the abundance of *Ficinia* spp., patches of *Bobartia gracilis* on stony outcrops and the occasional presence of *Cliffortia linearifolia*, *Selago corymbosa* and *Elytropappus rhinocerotis*. This influence does not extend beyond the Great Kei, however. Sourness varies a good deal, parts being relatively sweet, where *Themeda*, *Digitaria* and *Hyparrhenia* dominate on doleritic soil.

In Form (b), the grasses are the same, with the addition of *Pentaschistis angustifolia*, *Karrooochloa curva*, *Ehrhartia calycina*, *Setaria perennis* and patches of *Merxmeullera disticha*, while the fine wiry sedges (*Schoenoxiphium*, *Ficinia*, *Tetraria*,

FIG. 10.—Upper margin of Eastern Province Thornveld (7) just below the Dohne Sour Veld forests (44b) near Frankfort. Species noted: *Podocarpus falcatus* in forests, *Themeda triandra*, *Tristachya hispida* and *Elyonurus argenteus* in grassveld and *Acacia karroo* with *Themeda triandra*, *Digitaria monodactyla* and *Setaria sphacelata* in thornveld.



*Bulbosylistis*) are strongly represented, particularly in the sandier parts, where selective grazing will make the veld extremely sour. This form of the veld type occupies more broken country and the soil is generally poorer, on sandstone and quartzite, which together with the round-the-year rainfall, will explain both the frequency of relic patches of short forest and the importance of the Fynbos element. This latter appears in various ways, e.g. as invasions of *Elytropappus rhinocerotis*; as the pioneer on old fallows (*Gnidia myrtifolia*, *Selago corymbosa*, etc.); as a marginal fringe around bush-clumps and at the edge of the valley bushveld (*Passerina* sp., *Agathosma ovata*, *Aspalathus nivea*); as patches of *Bobartia gracilis* and *Leucospermum muirii*; or generally as single bushes scattered as forbs among the grass (*Metalasia muricata*, *Erica glumaeiflora*, *Aspalathus laricifolia*, *Struthiola parviflora*, *S. argentea*, *Corymbium africanum*, *Restio triticeus*, *Thamnochortus glaber*, *Anthospermum paniculatum*, *Pteronia teretifolia*, *Gnidia nodiflora*, *Euryops brachypodus*, *Agathosma cerefolium*, *Disparago ericooides*, *Muraltia macowanii*, *Arctopus* sp. etc.) and is encouraged by selective grazing.

Stages in the reversed succession are:

- (1) Short forest (the climax)
- (2) Bush clumps in sourish mixed thornveld
- (3) Sourish mixed to sour thornveld with some Fynbos species
- (4) Invasion by and thickening up of Fynbos species

In this veld type as a whole, soil erosion is not general, but it does occur, mainly at the edges of the valleys. *Senecio retrorsus* and others of the same group are sometimes abundant.

Included in this veld type is the anomalous veld to the west and south-west of King William's Town, a very open thornveld in which the ground surface is made up of a series of basins and hummocks two to three feet high of ripple form. These undulations appear to be caused by the activities of a large population of giant earthworms in a shallow soil on an impervious layer of concretionary ironstone. The *Themeda*-dominated grassveld, though of

slightly drier type, is similar to the typical form, but has a high proportion of *Cynodon dactylon*, *Sporobolus africanus*, *Eragrostis plana* and *Digitaria eriantha*, no doubt as a result of the soil-disturbing habits of the earthworms. These hummocks are of quite different nature and origin from the "heuweltjies" of the western coast belt.

Most of the veld types so far described occupy the ridges between the deep valleys of the rivers. Between these veld types and the valley bushveld, scrub and lowveld of the valleys are numerous interesting and instructive transitions; these however, can be more conveniently dealt with when describing the Valley Bushveld and related types.

## II INLAND TROPICAL FOREST TYPES

### 8 NORTH-EASTERN MOUNTAIN SOURVELD

[See Taljaard, Photos 80, 82, 90, 91, 94; Hutchinson, facing pp. 321 (Barberton, Graskop), 320 (Haenertsburg); Adamson, Photos 5, 6, 7]

Whereas southwards the tropical forest is confined to the coast belt, in the neighbourhood of Nongoma we find it occurring on the inland mountains as well. Extensive patches of it survive on the mountain range between Nongoma and Vryheid (Ceza, Ngome and other forests); northwards it occurs on the Louwsburg heights, the mountains of Swaziland, the mountains south and west of Barberton, there passing on to the Drakensberg and continuing northwards to the Soutpansberg, with outliers on the higher, wetter parts of the mountains westwards to the Waterberg. The rainfall is high, ranging on the average from 900 to over 1950 mm per annum, but it has been declining steadily for about 15 years.

The climax all through will have been high forest, and although kilometres of this forest survive (Fig. 11), especially north of the Crocodile River along the Drakensberg escarpment, most of it has been replaced by sour grassveld, a pure grassveld on the mountain tops, but a scrubby thornveld, reminiscent of that of the coast belt, on the escarpment and slopes.



FIG. 11.—Forest in the Graskop Gorge in the eastern Transvaal, the climax community of North-eastern Mountain Sourveld (8). Species noted: *Pterocelastrus echinatus*, *Podocarpus latifolius*, *Nuxia floribunda*, *Syzygium gerrardii*, *Trichocladus grandiflorus*, *Schefflera umbellifera*, *Combretum kraussii* and *Trema orientalis*.

Few really good samples of this forest have been examined; so far as the records go, the trees of general occurrence (excluding the Soutpansberg) are:—

Rapanea melanophloeos...	3 017	Halleria lucida....	61
Xymalos monospora.....	1 114	Ilex mitis.....	29
Podocarpus latifolius.....	744	Pittosporum viridiflorum....	27
Syzygium gerrardii	97	Kiggelaria africana	19
Combretum kraussii.....	90	Trimeria grandifolia....	11
Cussonia spicata...	84	Brachylaena discolor.....	7

#### Trees of less general occurrence include:—

Trichilia emetica...	517	Nuxia congesta....	10
Pterocelastrus echinatus.....	435	Rhus chirindensis forma legitati....	4
Trichocladus grandiflorus.....	435	Ficus capensis....	3
Curtisia dentata....	22	Trema orientalis....	3
Bersama tysoniana.	20	Apodytes dimidiata	3
Schefflera umbellifera.....	17	Cassipourea gerrardii....	3
Fagara davyi.....	16	Seemannaralia gerrardii....	3
Pygeum africanum.	16	Syzygium cordatum	2
Ptaeroxylon obliquum.....	12	Olea woodiana....	2
Nuxia floribunda...	10	Protorhus longifolia	2
		Scolopia zeyheri....	2

#### Shrubs and climbers of general occurrence are:—

Maytenus mossambicensis..	2 668	Canthium spinosum	272
Peddiea africana...	995	Burchellia bubalina	91
Psychotria capensis	978	Diospyros scabrida	var. cordata....
Bennia reticulata..	946	Scutia myrtina....	81
Clausena anisata...	877	Secamone alpini....	54
Cissampelos torulosa.....	859	Maesa lanceolata...	45
Asparagus setaceus	781	Grewia occidentalis	44
Rhoicissus rhomboidea....	694	Rhamnus prinoides	36
Carissa bispinosa...	688	Buddleia salviifolia	33
Senecio deltoideus.	485	Heteromorpha arborescens....	9

#### Shrubs and climbers of less general occurrence include:—

Mikania capensis...	742	Grumilea kirkii....	123
Cassinopsis ilicifolia.....	545	Berkheya bipinnatifida....	39
Cassine tetragona...	517	Rhoicissus tridentata....	38
Rubus sp.....	514	Calpurnia aurea	subsp. sylvatica...
Tylophora sp.....	499	Smilax kraussiana..	26
Cnestis natalensis...	494	Vaccinium exul....	26
Dalbergia obovata..	494	Acacia ataxacantha	25
Tricalysia lanceolata.....	435		

Allophylus dregeanus.....	373	Helinus integrifolius....	25
Diospyros whyteana.....	372	Hypericum revolutum....	25
Aloe arborescens..	248	Vernonia ampla....	25
Dioscorea cotinifolia.....	248	Dioscorea dregeana	20
Senecio quinquelobus....	248	Uvaria caffra....	20
Rhoicissus tomentosa....	247	Canthium gueinzii.	17
Ctenomeria capensis.....	123	Dracaena hookeriana....	17

and many more.

Generally occurring smaller plants of the forest-floor and margin are:—

Cyperus albostriatus.....	26 035	Polystichum luctuosum.....	731
Galopina circaeoides.....	25 130	Pteris catoptera....	671
Oplismenus hirtellus.....	16 000	Impatiens duthieana	457
Acanthaceae (various)....	9 136	Asparagus virgatus	166
Pellaea viridis.....	6 748	Argyrolobium tomentosum....	131
Blechnum attenuatum.....	4 817	Schistostephium rotundifolium....	81
Peperomia tetraphylla.....	3 806	Solanum aculeatissimum..	13
Moraea iridioides..	1 383	Cyathula cylindrica	8
Plectranthus spp...	1 301	Piper capense....	3
		Senecio panduraefolius...	3

#### Of less general occurrence are:—

Selaginella kraussiana.....	4 054	Stipa dregeana var. elongata.....	444
Sanicula elata....	3 178	Laportea penduncularis....	373
Begonia sp.....	2 311	Desmodium repandum....	372
Plectranthus spp...	2 311	Cyperus sp.....	123
Brachypodium flexum.....	2 289	Schoenoxiphium sparteum....	123
Stachys grandifolia	1 778	Clivia sp.....	123
Hyparrhenia cymbalaria....	1 584	Ehrharta erecta....	111
Clivia sp.....	1 423	Melinis macrochaeta	903
Ehrharta erecta....	1 423	Carex aquilinum....	109
Melinis macrochaeta	903	Asplenium aethiopicum....	494
Carex spicato-paniculata	741	Centella asiatica....	448
Asplenium aethiopicum....	494		
Centella asiatica....	448		

and many more, the total number of species in the Relative Abundance Table being 312.

The sourveld, the North-Eastern Mountain Sourveld, which replaces this forest is a strongly sour, *Themedia*-dominated veld (Fig. 12). It is not so dense as more southerly types, though the tufts may be larger.

Typical species are:—

<i>Themeda triandra</i> ...	330 400
<i>Loudetia simplex</i> ...	154 677
<i>Rendlia altera</i> ....	102 396
<i>Eragrostis racemosa</i>	87 200
<i>Monocymbium</i>	
<i>ceresiforme</i> ....	66 588
<i>Paspalum</i>	
<i>orbiculare</i> ....	58 790
<i>Eragrostis plana</i> ....	44 211
<i>Trachypogon</i>	
<i>spicatus</i> ....	34 906

The following are of lesser importance:—

<i>Sporobolus</i>	
<i>africanus</i> .....	2 392
<i>Setaria nigrigrostris</i> ..	2 353
<i>Digitaria</i>	
<i>monodactyla</i> ....	1 176
<i>Ficinia</i> spp.....	1 176
<i>Diheteropogon</i>	
<i>amplectens</i> ....	816
<i>Helichrysum</i>	
<i>oreophilum</i> ....	816
<i>Panicum ecklonii</i> ..	410
<i>P. natalense</i> ....	410
<i>Protea</i> sp. ....	410
<i>Diheteropogon</i>	
<i>filifolius</i> .....	204

<i>Brachiaria serrata</i>	
var. <i>serrata</i> .....	204
<i>Eulalia villosa</i> .....	204
<i>Cymbopogon</i>	
<i>validus</i> .....	186
<i>Elionurus argenteus</i>	118
<i>Festuca costata</i> ....	5
<i>Ctenium</i>	
<i>concinnum</i> .....	3
<i>Trichopteryx</i>	
<i>dregeana</i> .....	1
<i>Digitaria</i>	
<i>tricholaenoides</i> ...	1
<i>Erica</i>	
<i>drakensbergensis</i> .	1
<i>Protea roupelliae</i> .	1

Quite often one sees rows of *Alsophila dregei* along streams in the grassveld, while *Strelitzia caudata* is sometimes plentiful in the scrubby forest of precipitous slopes.

The scrubby thornveld of mountain slopes includes such species as *Athanasia acerosa*, *Lippia javanica*, *Stoebe vulgaris*, *Clifftoria linearifolia*, *Hypericum revolutum*, *Diospyros galpinii*, *Sutera grandiflora*, *Buddleia salviifolia* and *Leucosidea* along streams, *Maesa lanceolata*, *Solanum aculeastrum*, *Erica woodii*, *Dissotis princeps* and *Caesalpinia decapetala*, sometimes forming dense thickets where, apparently, the breaking down of the forest into grassveld or thornveld has never been completed. Much of this veld type has been replaced by plantations of pines, blue-gums and wattles.

## 9 LOWVELD SOUR BUSHVELD

(See Taljaard, Photos 97, 99; Hutchinson, pp. 323, 324, 370, 371, 372)

This veld type covers the lower eastern slopes and foothills of the mountains of Swaziland and of the Drakensberg and Soutpansberg northwards. It

is transitional between the Lowveld and the North-Eastern Mountain Sourveld and is related to the Waterberg Sourveld. The climax is probably tropical forest, the rainfall ranging from 500 mm per annum at the lower margin where it merges into the Lowveld, to over 1 000 mm at its upper margin, where it merges into the north-eastern mountain sourveld, its limits being somewhat indefinable. To-day it is either an open parkland, tall, well-formed trees well spaced in tall grassveld, or else bushveld dotted with big trees (Fig. 13).

Typical trees and shrubs in both forms are:—

<i>Trichilia emetica</i>	
<i>Parinari curatellifolia</i>	
subsp. <i>curatellifolia</i>	
<i>Sclerocarya caffra</i>	
<i>Acacia sieberana</i> var.	
<i>woodii</i>	
<i>Pterocarpus angolensis</i>	
<i>P. rotundifolius</i> subsp.	
<i>rotundifolius</i>	
<i>Faurea saligna</i>	
<i>Faurea speciosa</i> (at higher	
levels)	
<i>Acacia caffra</i>	
<i>A. davyi</i>	
<i>Ficus petersii</i>	
<i>F. ingens</i>	
<i>F. natalensis</i>	
<i>F. sycomorus</i>	
<i>Peltophorum africanum</i>	
<i>Diospyros mespiliformis</i>	
<i>Euphorbia ingens</i>	
<i>Lonchocarpus capassa</i>	
<i>Piliostigma thonningii</i>	

Belts of forest occur along the rivers, dense and tangled, with such lianas and scramblers as *Dalbergia obovata*, *D. armata*, *Bauhinia galpinii*, *Acacia ataxacantha*, *Smilax kraussiana* and *Toddalia asiatica*.

The grassveld constituent is tall, strongly tufted and relatively sparse, with a good deal of scrubiness. Common species are:—

<i>Hyperthelia dissoluta</i>	
<i>H. poecilotricha</i>	
<i>H. sp. cf. H. tamia</i>	
<i>Hyparrhenia cymbalaria</i>	
<i>Schizachyrium sanguineum</i>	
<i>Cymbopogon excavatus</i>	
<i>C. validus</i>	
<i>Andropogon schinzii</i>	
<i>A. schirensis</i>	
<i>Eragrostis</i> sp. cf. <i>E. curvula</i>	



FIG. 12.—North-eastern Mountain Sourveld (8) near Barberton in the eastern Transvaal. Prominent grasses are *Themeda triandra*, *Loudetia simplex* and *Rendlia altera*, while in the forest in the foreground are *Trichocladus grandiflorus*, *Syzygium gerrardii*, *Nuxia congesta*, *Pterocelastus echinatus* and *Olea woodiana*.



FIG. 13.—Lowveld Sour Bushveld (9) near Pretorius Kop in the Kruger National Park. Species noted: *Terminalia sericea*, *Sclerocarya caffra*, *Ficus sonderi* and *Hyperthelia dissoluta*.

<i>E. capensis</i>	<i>Lannea edulis</i>
<i>E. racemosa</i>	<i>Setaria chevalieri</i>
<i>Loudetia simplex</i> forma	<i>Vernonia ampla</i>
<i>Rhynchelytrum setifolium</i>	<i>Sutera grandiflora</i>
<i>Bracharia brizantha</i>	<i>Athrixia phyllocoidea</i>
<i>Heteropogon contortus</i>	<i>Helichrysum kraussii</i>
<i>Themeda triandra</i>	<i>Artemisia afra</i>
<i>Setaria sphacelata</i>	<i>Hypoxis rigidula</i>
<i>Pogonarthria squarrosa</i>	<i>Triraphis andropogonoides</i>
<i>Trachypogon spicatus</i>	

It is thus of sourish mixed nature, of poor quality for grazing and difficult to manage. *Themeda* and the other sward-forming grasses, while present, are no longer dominant as they are in the veld types hitherto described.

Spectacular soil erosion occurs in this veld, but is localized, taking the form of single dongas of great size and often of remarkable colouring—orange, rose-pink and pure white. It is a feature of granite country in the wetter parts and is also seen at Lions Head at Cape Town and Mallapynsberg in Rustenburg district. Some of these dongas are old, as evidenced by the size of the trees growing in them; and it is interesting to note how, at higher altitudes, e.g. in the Piet Retief Sourveld, or in drier country, e.g. at Magut, the forest species will colonize them. Such isolated dongas are capable of forming without any general denudation of the countryside, in cases where a natural dam across a river, in the shape usually of a dolerite dyke, becomes breached. The river-bed upstream is then likely to become scoured out, leaving high banks from which dongas have the opportunity of eating back along the tributaries. This could have happened long before the Bantu appeared on the scene, so that such dongas could provide natural migration routes for the forest into higher-lying or drier country.

### III TROPICAL BUSH AND SAVANNA TYPES (BUSHVELD)

#### 10 LOWVELD

[See Taljaard, Photos 83, 84; Marloth II, 2, Fig. 113; III, 2, Fig. 72; Hutchinson, facing pp. 321 (Komatipoort), 481 (Komatipoort), p. 367; King, Fig. 69.]

This veld type occupies the plains, at altitudes between 150 and 600 m above the sea, between the eastern foot of the Drakensberg and other mountains

southwards through Swaziland and Zululand, and the western foot of the Lebombo range, and replaces the valley bushveld in the deep valleys north of the Tugela. It also occurs along the eastern foot of the Lebombo Range. There is no clear-cut boundary between this veld (Figs. 14 and 15) and the Lowveld Sour Bushveld or the Zululand Thornveld, particularly on the lighter soils. Most of the soils, however, are heavy, derived from volcanic rocks, and on them the characteristic open *Acacia nigrescens-Sclerocarya-Themeda* Savanna of the Lowveld is developed. Large numbers of other species are often present, mainly in valleys, or on rocky hills and on the sandier soils; here the bush is denser.

Rainfall ranges from 500-750 mm per annum, falling in summer, and the climate is hot.

Typical trees and shrubs are:—

<i>Acacia nigrescens</i>	<i>Ozoroa paniculosa</i>
<i>Sclerocarya caffra</i>	<i>Ficus stuhlmannii</i>
<i>Ziziphus mucronata</i>	<i>Kigelia africana</i>
<i>Dichrostachys cinerea</i>	<i>Ormocarpum trichocarpum</i>
subsp. <i>africana</i>	<i>Bolusanthus speciosus</i>
<i>Maytenus senegalensis</i>	<i>Combretum apiculatum</i>
<i>Schotia brachypetala</i>	<i>C. heteroense</i>
<i>Euphorbia ingens</i>	<i>Grewia hexamita</i>
<i>E. tirucalli</i>	<i>G. tenax</i>
<i>E. confinalis</i>	<i>Cissus quadrangularis</i>
<i>E. cooperi</i>	<i>Albizia versicolor</i>
<i>Peltophorum africanum</i>	<i>Cladostemon kirkii</i>
<i>Dombeya rotundifolia</i>	(Lebombo)
<i>Lonchocarpus capassa</i>	<i>Phyllanthus reticulatus</i>
<i>Acacia davyi</i>	(Lebombo)
<i>A. nilotica</i> subsp. <i>krassiana</i>	<i>Vitex harveyana</i>
<i>A. senegal. var. leiorhachis</i>	(Lebombo)
<i>A. gerrardii</i> var. <i>gerrardii</i>	<i>Olax dissitiflora</i> (Lebombo)
<i>A. albida</i>	<i>Gossypium herbaceum</i> var. <i>africanum</i>
<i>A. burkei</i>	<i>Bauhinia galpinii</i>
<i>Acacia tortilis</i> subsp. <i>heteracantha</i>	<i>Sterculia murex</i>
<i>Syzygium guineense</i>	<i>Commiphora schimperi</i>
<i>Spirostachys africana</i>	<i>Strychnos madagascariensis</i>
<i>Euclea crispa</i> var. <i>crispa</i>	<i>Balanites maughamii</i>
<i>Manilkara concolor</i>	<i>Cussonia natalensis</i>
<i>Cassine transvaalensis</i>	<i>Kirkia wilmsii</i>
<i>Capparis tomentosa</i>	<i>Terminalia phanerophlebia</i>
<i>Olea africana</i>	<i>Diospyros glandulifera</i>
<i>Ozoroa engleri</i>	<i>Garcinia livingstonei</i>
<i>Cissus</i> sp. (=A. 13094)	<i>Cadaba natalensis</i>
	<i>Pterolobium exosum</i>

and many more.

Towards the upper margin, bush clumps occur, associated with termitaria, in which may be found the trees of the Lowveld Sour Bushveld. Along the rivers is generally a narrow belt of near-forest in

FIG. 14.—The Lowveld veld type (10) between Pretorius Kop and Skukuza in the Kruger National Park. Species noted: *Dicrostachys cinerea* subsp. *nyassana*, *Acacia* spp., *Combretum apiculatum*, *Pterocarpus rotundifolius*, *Sclerocarya caffra*, *Lannea discolor*, *Terminalia sericea*, *Themeda triandra*, *Digitaria eriantha*, *Schmidia pappophoroides* and *Panicum maximum*.



FIG. 15.—A succulent facies of Lowveld (10) near Komati poort in the eastern Transvaal. Conspicuous is *Euphorbia confinalis*.

which *Acacia robusta*, subsp. *robusta*, *A. albida*, *A. xanthophloea* (north of Hluhluwe R.), *Euphorbia tirucalli*, *Rauvolfia caffra*, *Phoenix reclinata*, *Hyphaene natalense* and *Ficus sycomorus* are conspicuous.

The dominant grass is a tall form of *Themeda triandra*, particularly on the heavy soils; on these soils it is associated with—

- Panicum maximum*
- P. deustum*
- Setaria woodii*
- Bothriochloa insculpta*
- Eragrostis superba*
- E. sp. cf. E. planiculmis*
- Aristida bipartita*
- Urochloa pullulans*

i.e. a good sweetveld. The creeping grasses and *Aristida bipartita* tend to become common with overgrazing.

On sandy soils, *Themeda* is less dominant and is associated with:—

- Eragrostis superba*
- E. sp. cf. E. tricophora*
- Aristida diffusa* var. *burkei*
- Heteropogon contortus*
- Aristida siccirus*
- Tristachya hispida*
- Elionurus argenteus*

- Digitaria* sp.
- Cymbopogon excavatus*
- Diplachne eleusine*
- Brachiaria* sp. cf. *B. stolonifera*
- Sporobolus fimbriatus*
- Setaria chevalieri* (along rivers)

- Digitaria tricholaenoides* (sometimes)
- Trichoneura grandiglumis*
- Panicum coloratum*
- Cymbopogon excavatus*
- Eragrostis gummiflua*
- E. lappula*

- Diheteropogon amplectens*
- Trichoæna monachne*
- Eustachys mutica*
- Sporobolus fimbriatus*
- Rhynchosperma repens*
- Eragrostis curvula*

- E. sclerantha*
- Polygonarthria squarrosa*
- Brachiaria nigropedata*
- B. serrata* var. *serrata*
- Cymbopogon plurinodis*
- Hyparrhenia hirta*

i.e. a mixed veld, rather on the sour side; it is poor and relatively sparse, and tends to tramp out to *Digitaria eriantha*, *Aristida congesta* subsp. *barbicollis*, *Eragrostis* sp. cf. *E. tricophora*, *Perotis patens*, *Polygonarthria* and such wiry grasses.

Forbs and bushy plants are plentiful, e.g.:—

- Lippia javanica*
- Helichrysum* sp. cf. *H. rosman*
- Talinum caffrum*
- Tephrosia semiglabra*
- Crotalaria laburnifolia*
- Orthosiphon serratus*
- Ocimum canum*
- Kalanchoe rotundifolia*
- Poikilia campestris*
- Sericocoma avolans*
- Oxygonum dregeanum* var. *canescens*
- Ipomoea crassipes*
- Felicia mossamedensis*
- Scilla* spp.

and many more.

## 11 ARID LOWVELD

(See Adamson, Photo 9)

This, too, is typically an *Acacia nigrescens-Sclerocarya* Savanna (Fig. 16), but with *Digitaria* sp. taking over the rôle of dominant grass from *Themeda*. *Acacia* spp. are more important and so are *Combretum* spp. especially *C. apiculatum*; and in parts northwards, *Colophospermum mopane*, providing an easy transition to Mopani Veld. Other typical trees and shrubs are:—

*Spirostachys africana*  
*Ziziphus mucronata*  
*Combretum imberbe*  
*Acacia exuvialis*  
*A. erubescens*  
*Euclea divinorum*  
*Grewia flavescens* and  
 others  
*Sterculia rogersii*  
*Terminalia prunioides*  
*Cassia abbreviata* subsp.  
 bearana

*Diospyros mespiliformis*  
*Ficus soldanella*  
*Steganotaenia araliaea*  
*Mundulea sericea*  
*Pterocarpus rotundifolius*  
 subsp. *rotundifolius*  
*Ximenia americana*  
*Maerua juncea* subsp.  
 crustata  
*Dalbergia melanoxylon*

with *Adansonia digitata* appearing north of the Olifants River.

The grasses include—

*Andropogon schinzii*  
*Cymbopogon plurinodis*  
*Heteropogon contortus*  
*Themeda triandra*  
*Schmidtia pappophoroides*

*Enneapogon scoparius*  
*Eragrostis superba*  
 E. sp. cf. *E. tricophora*  
*Digitaria eriantha*  
*Eustachys mutica*

This mixed veld breaks down to *Eragrostis* sp. cf. *E. tricophora*, *Schmidtia pappophoroides* and *Aristida congesta* subsp. *barbicollis* under grazing pressure.

This veld type requires further study; thus, it is probable that the western fringe of it should rather have been shown on the map as Lowveld. The southern outliers on the western side of the southern end of the Lebombo Range in the dry valleys of the Pongola and Umkuzi Rivers, however, have been better studied. The veld here is typical *Acacia nigrescens-Sclerocarya* Savanna, varying sometimes to *Acacia nigrescens-A. tortilis* subsp. *heteracantha*, or *Acacia nigrescens-Heeria* Savanna, with *Digitaria* sp. the dominant grass, together with much *Themeda*.

A feature of this veld is the dense, low thickets which occur along watercourses and along the foot of the Lebombo Range, both on the west and the eastern sides; they are reminiscent of the Addo Bush, though most of the species are different, and are related to the coastal jungle of Northern Zululand in the same way that the Addo Bush is related to the Alexandria Forest. On the banks of the main rivers, however, the usual tall near-forest with *Acacia xanthophloea* persists.

The principal species in the dense bush are:—

<i>Acacia luederitzii</i> var. luederitzii (dominant)	<i>Atalaya alata</i>
<i>A. nigrescens</i>	<i>Tecomaria capensis</i>
<i>Euclea undulata</i>	<i>Olea africana</i>
<i>Capparis sepia</i> var. citrifolia	<i>Prema mooenensis</i>
<i>C. tomentosa</i>	<i>Euphorbia grandicornis</i>
<i>Ehretia rigida</i>	<i>Ptaeroxylon obliquum</i>
<i>Acacia senegal</i> var. leiiorhachis (sometimes)	<i>Salvadora angustifolia</i> var. australis
<i>Sarcostemma viminale</i>	<i>Cordia caffra</i>
<i>Berchemia zeyheri</i>	<i>Chaetacme aristata</i>
<i>Dinocanthium hystrix</i>	<i>Schotia brachypetala</i>
<i>Maytenus heterophylla</i>	<i>Schotia capitata</i>
<i>Spirostachys africana</i>	<i>Cissus quadrangularis</i>
<i>Strophanthus gerrardii</i>	<i>Maytenus undata</i>
<i>Euclea divinorum</i>	<i>Teclea natalensis</i>
<i>E. schimperi</i> var. daphnoides	<i>Cladostemon kirkii</i> (foot of Lebombo)
<i>Pappea capensis</i>	<i>Azima tetracantha</i> (rare)
<i>Manilkara concolor</i>	<i>Euphorbia evansii</i> (rare)
	<i>E. ingens</i> (rare)
	<i>Cassine aethiopica</i>

with, amongst the smaller plants

<i>Panicum deustum</i>	<i>Asparagus falcatus</i>
<i>Baleria elegans</i>	<i>Bothriochloa insculpta</i>
<i>Justicia flava</i>	<i>Diplachne eleusine</i>
<i>Cissus</i> sp. = A. 13094	<i>Dicliptera quintasii</i>
<i>Sansevieria</i> sp. cf. S. zeylanica	<i>Polygalia sphenoptera</i>
<i>S. thrysiflora</i>	<i>Hibiscus calyphyllus</i>
<i>Talinum caffrum</i>	<i>Aloe</i> sp. ( <i>Saponariae</i> )

and a lot more.

Most of the remaining bushveld types, as has already been explained, have not been studied during this survey, so that little more will be said about them than was said in Irvine's Quinquennial Report on Toowoomba Research Station. As this report was not published, however, this information will be valuable.



FIG. 16.—Arid Lowveld (11) with *Acacia nigrescens* and *Sclerocarya caffra* near Satara in the Kruger National Park.

## 12 SPRINGBOK FLATS TURF THORNVELD

This veld type occupies the plains between the Waterberg and the Elands-Olifants valley, with a northward extension past Potgietersrust. It is extremely flat country, hot, with a summer rainfall of 450-750 mm per annum. It is naturally an open thornveld, but tends to thicken up when the grass cover is reduced by grazing mismanagement. Irvine has drawn the writer's attention to the fact that there is also a tendency for bush to invade areas where the grass cover is undamaged; it is suggested that this can only be the result of a climatic change, difficult to establish in these parts owing to the shortness of the records, but no doubt correlated with the undeniable change which has occurred in the older settled parts of the Republic.

Two main variations can be distinguished: (a) Red Turf veld, (b) Black Turf veld.

### (a) Red Turf veld

This is a fairly dense thornveld, the principal species being *Acacia tortilis* subsp. *heteracantha*, *A. nilotica* subsp. *kraussiana*, *Dicrostachys cinerea* subsp. *africana*, *Ziziphus mucronata*, *Acacia gerrardii* var. *gerrardii* and *Grewia flava* (Fig. 17). The grass is of a mixed type, dominated by *Themeda*, often with much *Cymbopogon plurinodis*. The principal species are:—

<i>Themeda triandra</i>	<i>Elionurus argenteus</i>
<i>Cymbopogon plurinodis</i>	<i>Panicum coloratum</i>
<i>Bothriochloa insculpta</i>	<i>Aristida canescens</i>
<i>Digitaria argyrograpta</i>	<i>Hyparrhenia hirta</i>
<i>Eragrostis superba</i>	<i>Eragrostis sp. cf. E. tricophora</i>
<i>Brachiaria nigropedata</i>	<i>Pogonarthria squarrosa</i>
<i>Heteropogon contortus</i>	

Selective grazing encourages *Cymbopogon*, while over-grazing will break it down to *Eragrostis* sp. cf. *E. tricophora*, *Bothriochloa* and *Hyparrhenia*, with abundance of *Aristida congesta* subsp. *barbicollis*. This veld occupies the relatively higher lying parts.

### (b) Black Turf veld

This is a more open thornveld, in low-lying places practically grassveld. The principal trees are

*Acacia karroo*, *A. nilotica* subsp. *kraussiana* and *Ziziphus mucronata*, scattered in a dense, tall, coarsely-tufted grassveld.

The principal species are:—

<i>Ischaemum afrum</i>	<i>Eragrostis chloromelas</i>
<i>Sehima galpinii</i>	<i>Panicum coloratum</i>
<i>Setaria woodii</i>	<i>Bothriochloa insculpta</i>
<i>Themeda triandra</i>	<i>Fingerhuthia africana</i>
<i>Elionurus argenteus</i>	<i>Enneapogon scoparius</i>
<i>Digitaria sp.</i>	

*Sehima* is apparently the climax species, still persisting as dominant in protected low-lying places. Other species often of importance are *Sorghum versicolor*, *Aristida bipartita* and the annuals, *Sesbania mossambicensis* and *Brachiaria eruciformis*. These are associated with ancient cultivation, but are very persistent. *Aristida bipartita* is dominant over large areas.

In both these forms overgrazing causes the bush to thicken up into almost impenetrable thickets of *Acacia nilotica* subsp. *kraussiana*, *Dichrostachys cinerea* subsp. *africana*, *Maytenus heterophylla* and *Acacia karroo*, while in low lying places the shorter *Acacia tenuispina* (especially on black turf), *A. kraussiana* (shrubby form), *A. luederitzii* var. *luederitzii*, *Grewia flava*, *Asparagus laricinus* and *A. stipulaceus* also become common, shading out the grasses and greatly reducing the grazing value of the veld.

An intermediate form between the Red and the Black Turf veld is the Chocolate Turf veld, a fairly dense *Acacia nilotica* subsp. *kraussiana* thornveld with *Acacia karroo* and *A. tortilis* subsp. *heteracantha*, in a *Themeda*-*Setaria woodii* grassveld with *Bothriochloa insculpta*, *Elionurus argenteus* and sometimes *Sehima*.

Much cultivation is carried on on the Springbok Flats, but (in spite of the apparently almost inexhaustible fertility of the soil), the erratic nature of the rainfall, the heat, and the relatively poor quality of the grazing in winter make it difficult country for farming.



FIG. 17.—Red Turf veld (12a) on the Springbok Flats near Radium in the Transvaal. Species noted: *Acacia tortilis* and *Grewia flava* with much *Themeda triandra* and some *Cymbopogon plurinodis*, *Aristida bipartita*, *Bothriochloa insculpta*, *Digitaria argyrograpta*, *Eragrostis superba*, *Heteropogon contortus* and *Panicum coloratum*.

FIG. 18.—Black Turfveld (12b) on the Springbok Flats near Radium in the Transvaal. Species noted: *Acacia tortilis* with *A. nilotica*, *A. karroo*, *Asparagus laricinus*, *Ischaemum afrum*, *Schinia galpinii*, *Setaria woodii* and much *Themeda triandra* and *Digitaria* sp.



### 13 OTHER TURF THORNVELD

Under this heading falls a group of closely related variations of turf thornveld, some of them occurring in such a way as to be individually unmappable on a small scale.

(a) Along the edge of the Elands-Olifants valley, the turfveld of the Springbok Flats merges into the short scrub of the dry valley via a scrubby, rocky belt of short bushveld on a light, grey, turf-y soil with a layer of calcareous tufa, often outcropping. Wherever such grey turf on limestone appears in the drier parts of the bushveld and lowveld, a generally similar type of veld is found, rather resembling the drier parts of the Vryburg Shrub Bushveld or the arid kalkveld of South West Africa. There is no extensive area of it, and as it occurs widely scattered as small patches and strips, it shows wide variations. Typical species are:—

<i>Commiphora pyracanthoides</i>	<i>Rhus</i> spp.
<i>Boscia foetida</i> subsp. <i>reemanniana</i>	<i>Maytenus</i> spp.
<i>Grewia flava</i>	<i>Olea africana</i>
<i>G. bicolor</i>	<i>Acacia tortilis</i> subsp. <i>heteracantha</i>
<i>Euclea undulata</i>	<i>A. karroo</i>
<i>Acacia mellifera</i> subsp. <i>dentinens</i>	<i>A. gerrardii</i> var. <i>gerrardii</i>
<i>Rhigozum obovatum</i>	<i>A. stuhlmannii</i>
<i>R. brevispinosum</i>	<i>Dichrostachys cinerea</i>
<i>Tarchonanthus camphoratus</i> var. <i>camphoratus</i>	<i>subsp. africana</i>
	<i>Boscia albitrunca</i>

while the grassy constituent is mainly sweet.

<i>Cenchrus ciliaris</i>	<i>Panicum coloratum</i>
<i>Heteropogon contortus</i>	<i>Schmidtia pappophoroides</i>
<i>Digitaria eriantha</i>	<i>Brachiaria nigropedata</i>
<i>Panicum maximum</i>	<i>Cymbopogon plurinodis</i>
<i>Enneapogon scoparius</i>	<i>Elionurus argenteus</i>
<i>Eragrostis</i> sp.	<i>Themeda triandra</i>

but is usually broken down to *Aristida congesta* subsp. *barbicollis*, *A. congesta* subsp. *congesta* and bushy plants, e.g. *Stachys* sp., *Evolvulus alsinoides*, *Melhania* sp. and, particularly, Acanthaceae of the genera *Justicia*, *Blepharis*, *Dyschoriste* and *Petalidium*.

(b) The large areas of "Other Turf Thorneveld" shown on the veld type map are mainly what Irvine calls *Acacia karroo-Cymbopogon* Veld, or Norite Black Turfveld, with a variation to Red Turfveld as in the case of the Springbok Flats Turfveld, and

similarly tending to be dominated by *Cymbopogon plurinodis* (Fig. 19). It is typically an open savanna of short *Acacia karroo* with more or less *Acacia robusta* subsp. *robusta* (sometimes dominant), *A. tortilis* subsp. *heteracantha* and stunted *Grewia flava* and *Rhus gueinzii*, while *Acacia nilotica* subsp. *kraussiana*, so important on the Springbok Flats, is usually scarce. The important grasses include:—

<i>Setaria</i> sp.	<i>Panicum coloratum</i>
<i>Ischaemum afrum</i>	<i>Aristida bipartita</i> (sometimes)
<i>Cymbopogon plurinodis</i>	<i>Elionurus argenteus</i>
<i>Fingerhuthia africana</i>	<i>Digitaria</i> sp.
<i>Urelytrum</i> sp.	
<i>Eragrostis chloromelas</i>	

Where the Norite forms hills, as it does in the southern strip of turfveld along the northern foot of the Magaliesberg, the vegetation is a dense, short bushveld, with such species as:—

<i>Combretum molle</i>	<i>Ficus petersii</i>
<i>Acacia caffra</i>	<i>Celtis africana</i>
<i>Clerodendrum glabrum</i>	<i>Rhus gueinzii</i>
<i>Vangueria infausta</i>	<i>Croton gratissimus</i>
<i>Euclea crispa</i> var. <i>crispa</i>	<i>Cussonia paniculata</i>
<i>Kirkia wilmsii</i>	<i>Combretum hereroense</i>
<i>Dombeya rotundifolia</i>	<i>Rhoicissus tridentata</i>
<i>Sclerocarya caffra</i>	<i>Pouzolzia hypoleuca</i>
<i>Pappea capensis</i>	<i>Diospyros whyteana</i>
<i>Grewia flava</i>	<i>Helicia integrifolius</i>
<i>Acalypha glabrata</i>	<i>Grewia occidentalis</i>
<i>Urera tenax</i>	<i>Lannea discolor</i>
<i>Ziziphus mucronata</i>	<i>Brachylaena rotundata</i>
<i>Ficus ingens</i>	

i.e. decidedly mixed, including species even of forest affinity, while the grasses, etc. (in a rather tramped-out sample) include:—

<i>Setaria lindenbergiana</i>	<i>Dichanthium papillosum</i>
<i>Heteropogon contortus</i>	<i>Oropetium capense</i>
<i>Sporobolus festivus</i>	<i>Tripogon minimus</i>
<i>Bothriochloa insculpta</i>	<i>Sporobolus stapfianus</i>
<i>Digitaria</i> sp.	<i>Cenchrus ciliaris</i>
<i>Themeda triandra</i>	<i>Glycine javanica</i>

The geological structure of the Rustenburg and Marico districts along the western rim of the bushveld lopolith, is so complex, with the norite and quartzites outcropping in alternating belts, that mixed and layered soil-types are of common occurrence, with correspondingly mixed vegetation, e.g. *Acacia caffra* on what is superficially black turf, while around Nietverdiend in Marico district, *Acacia erioloba* forms a distinct veld type, (c), on light turf-y soil, although this tree is generally associated with deep sand over limestone.

FIG. 19.—Norite Black Turf veld (13b) near Saulspoort in the Transvaal, with *Acacia karroo* and *Cymbopogon plurinodis*.



(d) Another widely occurring form of grey turf veld, especially in the mixed bushveld to the west and north of the Waterberg is *Knoppiesdoring Veld* (Fig. 20). It occurs only as small patches and narrow strips along dykes of basic volcanic rock, sometimes scarcely more than a single row of tall Knoppiesdoring trees (*Acacia nigrescens*) in a strip of sweet *Grewia flava* veld a few metres wide. *Acacia nigrescens* here grows much taller and straighter than it does in the Lowveld. The grass is mainly *Cenchrus ciliaris*, with *Bothriochloa insculpta*, *Digitaria eriantha*, *Enneapogon scoparius* and *Setaria* sp. Here it has been noticed that a surface layer of quartz gravel can cause the under-storey of *Grewia flava* to be replaced by *Acacia caffra*.

When the bushveld region is included in the detailed survey, some of these turf thornveld variations will have to be separated as distinct veld types.

#### 14 ARID SWEET BUSHVELD

[See Reynolds, Pl. 35; Hutchinson, p. 394, facing p. 481 (Limpopo Valley)]

As delimited on the veld type map, this too is a somewhat heterogeneous type. Thus Irvine recognizes seven sweet veld types, viz:—

- (a) Dwarf *Terminalia sericea-Rhigozum* Veld
- (b) *Grewia flava* (Maretwa) Veld, including
- (c) Dwarf *Combretum apiculatum* Veld; and
- (d) *Commiphora pyracanthoides* Veld
- (e) *Adansonia*-Mixed Thorn Veld
- (f) *Panicum maximum-Acacia karroo* Veld
- (g) *Dichrostachys-Acacia* Veld

which, until the data have been collected to describe them fully as distinct veld types, we will describe, mainly in Irvine's words, as variations of the broad type, Arid Sweet Bushveld.



FIG. 20.—Knoppiesdoring (*Acacia nigrescens*) Veld (13d) at Groenvlei, north of the Kransberg in the Transvaal.

### (a) Dwarf Terminalia sericea-Rhigozum sp. Veld

This veld type covers some 1 850 square km in the valley of the Limpopo between the Matlabas and Mogol Rivers, extending some distance east of the Mogol and lying at an elevation of 800-950 m (Fig. 21). A further portion of the above area of veld occurs in the Palala valley to the south of Villa Nora. The soil is a deep, fine grey-brown sand overlying granite, quartzite, sandstone and shale. The rainfall varies from 350-500 mm.

"This veld type is a short scrubby formation of *Terminalia sericea* and *Rhigozum* sp., together with stunted *Grewia flava* and *Acacia tortilis* subsp. *heteracantha*. The grass, typical of deep, loose sand is of a coarse, harsh nature—*Eragrostis pallens*, *Schmidtia pappophoroides* var., *Eragrostis tricophora*, *Loudetia simplex*, *Aristida graciliflora* and *A. sp.* These is evidence that formerly sweet grasses such as *Digitaria* and *Panicum* spp. were more abundant".

(b), (c), (d).—"These three types, together covering about 4 800 square km, extend along the Limpopo valley, in two blocks. The upper or more western block lies between the Crocodile and Matlabas Rivers, and is separated from the lower block by the sandy Dwarf *Terminalia*-*Rhigozum* Veld. This latter block lies between the Mogol and Magalakwin Rivers in the Limpopo valley, but extends southwards across the latter river as far as the Blouberg and Soutpansberg. It is bounded on the north-east by the Mopani Veld, along an irregular south-easterly line from near the mouth of the Magalakwin River to the neighbourhood of Waterpoort, with extensions along the valleys of the Brak and Sand Rivers nearly to their junction. The altitude ranges from 700-950 m and the rainfall is 350-450 mm. The underlying rock throughout is granite and gneiss, and the typical soil is shallow, gritty and light red in colour, over a limestone layer".

"The entire area indicated above carries *Grewia flava* Veld, except in shallow depressions where the limestone layer is at, or near the surface, where Dwarf *Commiphora* Veld occurs."

### (b) Grewia flava Veld

"This veld type is a fairly dense growth of *Grewia flava* (Maretwa) with a good deal of *Acacia erubescens* (Geelhaak), *A. mellifera* subsp. *detinens* and *Dichrostachys cinerea* subsp. *africana* in varying proportions, some *Commiphora pyracanthoides* and scattered taller trees of *Boscia albitrunca* (Matlopi) and *Acacia tortilis* subsp. *heteracantha* (Haak en steek) (Fig. 22). *Boscia* is the most conspicuous tree, here growing with a tall straight trunk. The grass is naturally decidedly sweet, but has in many parts given place to *Aristida* spp. (Steekgras). *Schmidtia pappophoroides*, *Eragrostis* sp. and *Panicum maximum* are the major species with much *Digitaria eriantha* and *Panicum coloratum* and rather less *Enneapogon scoparius*, *Brachiaria nigropedaat* and *Heteropogon contortus*". This description can be amplified somewhat: typical trees and shrubs are:—

<i>Grewia flava</i>	thickets	<i>Ziziphus mucronata</i>
<i>Acacia erubescens</i>		<i>Dichrostachys cinerea</i> subsp. <i>africana</i>
<i>A. mellifera</i> subsp. <i>detinens</i>		<i>Commiphora pyracanthoides</i>
<i>A. luederitzii</i> var. <i>luederitzii</i>		<i>Maytenus tenuispina</i>
<i>A. tortilis</i> subsp. <i>heteracantha</i>		<i>Peltorphorum africanum</i>
<i>Boscia albitrunca</i>		<i>Terminalia sericea</i>
<i>Acacia karroo</i>		<i>Grewia</i> spp.
<i>A. erioloba</i> (southwards)		<i>Rhigozum</i> sp. cf. R. <i>obovatum</i>
<i>Cadaba aphylla</i>		<i>Euclea undulata</i>

while the grasses, etc., include:—

<i>Schmidtia pappophoroides</i>	<i>Dipcadi glaucum</i>
<i>Eragrostis</i> sp. cf. E. <i>tricophora</i>	<i>Acanthosigcos naudiniana</i>
<i>Digitaria eriantha</i>	<i>Brachiaria nigropedaat</i>
<i>Heteropogon contortus</i>	<i>Urochloa pullulans</i>
<i>Panicum coloratum</i>	<i>Eragrostis superba</i>
<i>Aristida congesta</i> subsp. <i>barbicollis</i>	<i>Anthepron pubescens</i>
<i>Aristida congesta</i> subsp. <i>congesta</i>	<i>Stipagrostis uniplumis</i>
<i>Enneapogon scoparius</i>	<i>Indigofera daleoides</i>
<i>Panicum maximum</i> (ab T.)	<i>Chrysopogon serrulatus</i> (IC)
	<i>Cymbopogon plurinodis</i>



FIG. 21.—Dwarf *Terminalia sericea*-*Rhigozum* sp. Veld (14a) between Buffelsdrift and Stockpoort in the Transvaal. Species noted: *Terminalia sericea*, *Rhigozum* sp., *Grewia flava*, *Boscia albitrunca*, *Eragrostis pallens*, *Schmidtia pappophoroides* and *Aristida* spp.

FIG. 22.—*Grewia flava* Veld (14b) near Tom Burke in the north-western Transvaal. Species noted: *Grewia flava* with scattered *Boscia albitrunca* trees and sparse *Combretum apiculatum*, *Acacia tortilis* subsp. *heteracantha* *Boscia rehmannii*, and *Commiphora pyracanthoides*. The grasses are *Aristida congesta* subsp. *congesta* and subsp. *barbicollis*, *Stipagrostis umiplanis* and *Eragrostis lehmanniana*.



"In the section to the north of the Blouberg and Soutpansberg, where the rainfall is lower and the soil shallower, this veld is more scrubby and there are some floristic differences, xerophytic shrubs like *Commiphora* spp., *Terminalia prunioides* and *Sesamothamnus lugardii* becoming common.". To which may be added *Boscia foetida* subsp. *rehmanniana*, *Psiadia punctulata*, *Leucosphaera bainesii*, *Sterculia rogersii*, *Acacia nigrescens* (stunted) and *Catophractes alexandri*.

#### (c) Dwarf *Combretum apiculatum* Veld

This veld type occurs to the west of the Palala, where the soil is a shallow, fine, yellow-brown sandy loam (Fig. 23).

#### (d) Dwarf *Commiphora* Veld (Kurkbossie)

This veld type is a rather mixed scrubby type dominated by a dwarf form of *Commiphora pyracanthoides*. Stunted *Acacia tortilis* subsp. *heteracantha*, *Combretum apiculatum*, *Grewia flava* and *Terminalia sericea* are plentiful. The grass, on this

shallow, calcium rich soil, is sweet and short. The most abundant grasses are *Urochloa* sp. and *Sporobolus nitens*, with much *Panicum coloratum* and some *Anthephora pubescens*, *Cenchrus ciliaris* and *Enneapogon scoparius*".

#### (e) Adansonia-Mixed Thornveld

"Covers 5 100 square km immediately to the south of the *Grewia flava* Veld just described. It occurs in two blocks, one in the shape of a horseshoe, the horns occupying the middle Palala and Magalakwin valleys—linked by a narrow belt towards the Limpopo Valley (Fig. 24). The other, or eastern block, occupies the relatively dry, low-lying area between the Blouberg and Soutpansberg on the north and the Magabeneberg, the northern slopes of the Pietersburg Plateau and the Drakensberg on the west, south and east respectively. The altitude ranges from 750-1 050 m, with a rainfall of 400-500 mm. The underlying rock is again mostly granite, with some Waterberg rocks in the Magalakwin valley, but the soil, a red sandy loam, is deeper and better."



FIG. 23.—Dwarf *Combretum apiculatum* Veld (14c) near Beauty in the north-western Transvaal. Species noted: almost pure *Combretum apiculatum* with some *Grewia flava* and *Dicrostachys cinerea* subsp. *glomerata*; grasses include *Aristida* spp., *Brachiaria nigropedata*, *Panicum maximum*, *P. coloratum*, *Cymbopogon plurinodis* etc.

FIG. 24.—*Adansoria*—Mixed Thornveld (14e) at Swartwater in the north-western Transvaal. *Adansonia digitata* in the foreground and thornveld in the background.



The bush comprises the same species as the *Grewia flava* Veld, but is bigger and these is less *Grewia flava*. It also includes *Sterculia rogersii*, *Strychnos* spp., *Acacia* spp. and *Adansonia digitata*, at least in the section to the north-west of the Soutpansberg; *Adansonia* does not occur in the eastern block. *Hyphaene* sp. occurs along rivers in the Limpopo valley. The grass sward is very similar to that of *Grewia flava* Veld, with the addition of more *Antheophora pubescens*, *Eragrostis superba* and *Themeda triandra*, due to the heavier soil."

#### (f) *Panicum maximum-Acacia karroo* Veld

This is the veld of the silty banks of the main rivers, a narrow belt to be measured in hundreds of metres even at its widest (Fig. 25). It may also

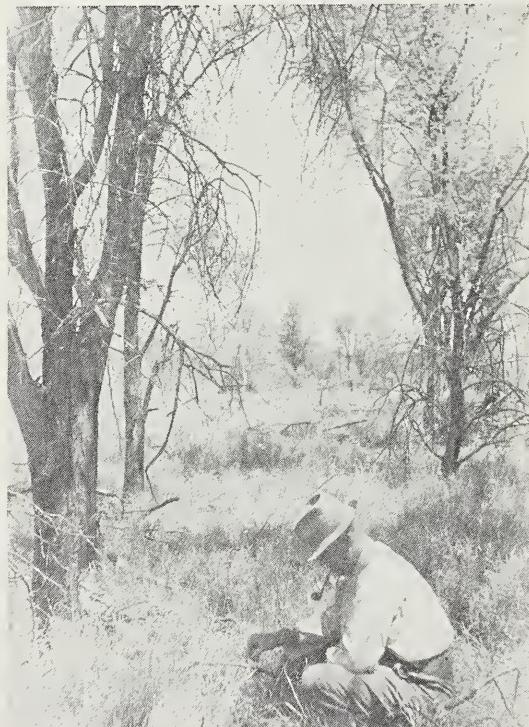


FIG. 25.—*Panicum maximum*—*Acacia karroo* Veld (14f) in the Matlabas Valley in the western Transvaal.

occur in depressions in the neighbourhood of basic intrusions, where there is deep, rich soil and permanent, underground water. It traverses all the sweet and mixed bushveld, and in the sparsely and recently settled bushveld it can still be seen in its full development of tall straight *Acacia karroo* trees standing deep in a luxuriant growth of *Panicum maximum*. It is not confined to the bushveld region, however; indeed, it is one of the most widely distributed plant communities. Traces of it are to be seen all along the east and south coasts and through all but the coldest and driest parts of the Karoo region, but as a general rule the *Panicum* has been replaced by dongas. In parts, *Acacia karroo* and *Panicum maximum* are the only plants of importance, e.g. along parts of the Matlabas River, but usually there are a few other trees and grasses as well, e.g. *Combretum erythrophyllum* and its allies, *Ziziphus mucronata*, *Diospyros pallens*, *Rhus lancea* and other *Rhus* spp., *Panicum deustum*, *Bothriochloa insculpta*, *Chloris gayana* and *Setaria woodii*. In the Karroo region, *Panicum staphianum*, *Setaria neglecta*, *Digitaria* sp. and *Sporobolus fimbriatus* are rather the associates of the two *Panicum* spp., sometimes largely replacing them, e.g. at Doornhoek, near Cradock to the west. Along the Vaal River and its tributaries, *Dichanthium papillosum* and *Eragrostis rotifer* become important members of the community, as well, sometimes as *Echinochloa holubii*, *Panicum laevifolium* and *Diplachne fusca*. The association of the last three (which are vlei-grasses) with *Acacia karroo* is, however, probably artificial. It could come about when conversion of the river into a donga had drained the former riverine vlei sufficiently to permit *Acacia karroo* to invade.

#### (g) *Dichrostachys-Acacia* Veld

This community occurs on hard, brak, sandy slopes on the sides of river valleys in the drier parts of the bushveld above the silt level. It, too generally occurs as narrow belts, rarely as much as 0,8 km wide, but there is one extensive area of it along the Marico River below Derdepoort (Fig. 26); further, it is not confined to the main river valleys, but occurs along minor watercourses and in brak depressions, e.g. Warmbaths stands in a patch of it, which includes the north-western corner of Toowoomba Research Station; this, however, is a somewhat wetter variation of it.

In the drier parts it is a dense, short growth of *Acacia mellifera* subsp. *detinens*, *A. erubescens*, *Dichrostachys cinerea* subsp. *africana* and sometimes *Acacia luederitzii* v. *leuderitzii*, often forming impenetrable thickets, with a good deal of *Boscia albitrunca* and *B. foetida* subsp. *rehanniana*. In the less dry parts, e.g. at Warmbaths or 30 km north of Pretoria on the Warmbaths road, the dominants are *Dichrostachys*, stunted *Acacia tortilis* subsp. *heteracantha*, *Euclea undulata*, *Spirostachys africana*, *Carissa bispinosa*, *Sarcostemma viminale*, *Senecio pleistocephalus* and *Maytenus heterophylla* sometimes also *Acacia nilotica* subsp. *kraussiana*.

The principal grasses, etc., are:—

<i>Sporobolus nitens</i>	<i>Enneapogon scoparius</i>
<i>Urochloa</i> sp. (creeping)	<i>Fingerhuthia africana</i>
<i>Panicum coloratum</i>	<i>Sporobolus festivus</i>
<i>Eragrostis obtusa</i>	<i>Pterodiscus speciosus</i>
<i>Cyperus tenerifae</i>	<i>Mariscus</i> sp. (A. 12460)
<i>C. semitrifidus</i>	<i>Kyllinga alba</i>

while there is a dense, semi-succulent undergrowth in the thickets, including:—

<i>Kalanchoe rotundifolia</i>	<i>Commelinia benghalensis</i>
K. sp.	<i>Pollichia campestris</i>
<i>Crassula sessiliflora</i>	<i>Coleus neochilus</i>
<i>C. transvaalensis</i>	<i>Aloe transvaalensis</i>
<i>Senecio</i> sp. cf. <i>S. fulgens</i>	<i>Xerophyta viscosa</i>
<i>Cyanotis speciosa</i>	<i>Asparagus stipulaceus</i>
<i>Justicia flava</i>	<i>Sansevieria hyacinthoides</i>
<i>Ruellia</i> sp.	? <i>Delosperma</i> sp.
<i>Felicia muricata</i>	

Soil erosion is a conspicuous feature of this community, which itself is probably largely the result of concentration of grazing caused both by its sweetness and its position in the neighbourhood of water, the climax probably having been something approaching *Grewia flava* Veld. This veld is the north-western equivalent of the dense scrub of Zululand (see p 30.) and the Valley Bushveld and its allies. Less scrubby forms of it occur, too, but these will be described with the Mixed Bushveld as Thornveld and *Combretum imberbe* Veld.

## 15 MOPANI VELD

[See Hutchinson, p. 326, facing pp. 416, 417 (Messina), 481 (Messina)]

There are two blocks of this distinct veld type: (1) in the wide, gently undulating valley of the Limpopo north of the Soutpansberg; altitude ranges from 400-750 m and the rainfall from 250-400 mm per annum, strictly confined to the summer months. The climate is very hot (Fig. 27). (2) A broad belt running south from the eastern part of the Soutpansberg nearly to the Olifants River and including the northern part of the Kruger National Park (Figs. 28 and 29). This latter block is wetter, rainfall being over 400 mm per annum and the altitude from under 300-450 m. The vegetation is taller and more mixed, but little information is available about it.



FIG. 26.—*Dichrostachys-Acacia* Veld (14g) near Derdepoort, in the western Transvaal. Species noted: *Dichrostachys cinerea* subsp. *africana*, *Acacia tortilis*, *A. erubescens*, *Boscia albitrunca* with *Panicum maximum*, *P. coloratum* and *Urochloa mossambicensis*.



FIG. 27.—Mopani Veld (15) in the Limpopo Valley viewed from Mt Singalele. *Colophospermum mopane* with scattered specimens of *Adansonia digitata*.



FIG. 28.—Mopani Veld (15) consisting of tall *Colophospermum mopane* on the banks of the Shingwidzi River in the Kruger National Park.



FIG. 29.—Mopani Veld (15) consisting of short and scrubby *Colophospermum mopane* on the Lebombo Flats between Shawolaagte and Shawopool in the Kruger National Park.

In the north-western block of Mopani Veld, the vegetation is typically a short, fairly dense growth of scrubby *Colophospermum mopane*, generally associated with a number of other trees and shrubs in a somewhat sparse and tufted grassveld. The trees and shrubs include:—

*Colophospermum mopane*  
*Acacia tortilis* subsp.  
*heteracantha*  
*A. nigrescens* and others  
*Combretum apiculatum*  
*Sclerocarya caffra*  
*Dichrostachys cinerea*  
*subsp. africana*  
*Cadaba terminalia*  
*Schotia capitata*  
*Boscia foetida* subsp.  
*reemanniana*

The grass layer includes:—

*Anthephora pubescens*  
*Brachiaria nigropedata*  
*Bothriochloa insculpta*  
*Eragrostis superba*  
*Schmidia pappophoroides*  
*Heteropogon contortus*  
*Stipagrostis uniplumis*  
*Chloris roxburghiana*

*Boscia albitrunca*  
*Cassia abbreviata* subsp.  
*beariana*  
*Commiphora* spp.  
*Grewia* spp.  
*Ximenia* sp.  
*Lycium* sp.  
*Terminalia prunioides*  
*Adansonia digitata*

*Tricholaena monachne*  
*Eragrostis nindensis*  
*Cenchrus ciliaris*  
*Panicum maximum*  
*(patches)*  
*Digitaria eriantha* (patches)  
*Neorautanenia* sp.

but is usually reduced to *Eragrostis* sp. cf. *E. tricophora*, together with annuals like *Aristida congesta* subsp. *barbicollis* and *Enneapogon cenchroides*.

In parts, the Mopani is stunted and completely dominant; while in the main valleys the bush is more mixed and not dominated by Mopani. Here is the usual riverside growth of tall *Acacia karroo* and *Panicum maximum*, with more or less *Boscia foetida* subsp. *reemanniana*, *B. albitrunca*, *Acacia tortilis* subsp. *heteracantha*, *Commiphora pyracanthoides*, *Terminalia prunioides*, *Mundulea sericea* and thickets of *Acacia mellifera* subsp. *detinens*, *A. erubescens* and others, but in addition, such curiosities as *Sesamothamnus lugardii* and *Catophractes alexandri* occur, plants which are more important along rocky watercourses and koppies. Very little information is available at this stage, however, about these interesting variations. *Adansonia digitata*, the Baobab, occurs scattered all through this veld type. North of the Limpopo the Mopani Veld develops into something very like forest, straight trees up to 10 m high forming a closed canopy, and with little undergrowth.

## 16 KALAHARI THORNVELD

There are two main subdivisions of this type:—

- (a) Kalahari Thornveld Proper
- (b) Vryburg Shrub Bushveld

### (a) Kalahari Thornveld Proper

Kalahari Thornveld Proper occurring on deep loose sand over calcareous tufa. This is the more extensive in area and has four subdivisions:—

(1) North-eastern, in the Transvaal, transitional to bushveld. One form of this has been mentioned (p. 32) as occurring anomalously on turf soil around Nietverdiend. The other occurs on sand around Pienaar River with outliers eastwards.

(2) Eastern, in the Western Free State, Western Transvaal and Vryburg and Mafeking divisions; an *Acacia erioloba*—Savanna with the grasses of the Dry *Cymbopogon-Themedea* Veld and some of those of the Bankenveld.

(3) Central, along the line Hopetown-Kimberley-Vryburg; an *Acacia erioloba* Savanna with some of the grasses of the Dry *Cymbopogon-Themedea* Veld and some of those of the western form.

(4) Western and north-western, west of the Asbestos, Kuruman and other hills northwards, and the most extensive variation; a generally very open savanna of *Acacia haematoxylon* and *A. erioloba* with desert grasses.

(1) *The North-eastern Form of the Kalahari Thornveld*.—The main block of this veld occurring on sand lies in the neighbourhood of Pienaar River Station. It is not typical, being transitional both to the Vryburg Shrub Bushveld and the Mixed Bushveld, and has suffered much from mismanagement.

*Acacia erioloba* is the largest tree, in parts rare, elsewhere fairly common, associated with—

<i>Acacia tortilis</i> subsp. heteracantha	<i>Grewia flava</i>
<i>A. mellifera</i> subsp. <i>detinens</i>	<i>Boscia albitrunca</i>
<i>A. luederitzii</i> var. <i>luederitzii</i>	<i>Dichrostachys cinerea</i> subsp. <i>africana</i>
<i>Tarchonanthus</i> <i>camphoratus</i> var. <i>litakunensis</i>	<i>Mundulea sericea</i>

and a little *Euclea undulata*, *Ziziphus mucronata*, *Diospyros pallens* and *Peltophorum africanum*. *Acacia tortilis* subsp. *heteracantha*, *A. mellifera* subsp. *detinens*, *A. luederitzii* var. *luederitzii* and *Dichrostachys* tend to develop into thickets, often with abundance of *Aloe davyana*.

The climax grasses appear to be—

<i>Eragrostis superba</i>	<i>Heteropogon contortus</i>
<i>Cymbopogon plurinodis</i>	<i>Panicum coloratum</i>
<i>Themeda triandra</i>	<i>Enneapogon scoparius</i>
<i>Elionurus argenteus</i>	<i>Eustachys mutica</i>

with *Panicum maximum* under the trees, but to-day *Eragrostis* sp. cf. *E. tricophora*, *Digitaria eriantha*, *Trichoneura grandiglumis* and *Mosdenia leptostachys* are more plentiful.

Patches of *Terminalia* veld occur, as they do along the north edge of the eastern variation of the Kalahari Thornveld in Kuruman and Vryburg divisions.

The eastern outliers on the southern edge of the Springbok Flats and in the Chalate Valley are more typical in being dominated by *Acacia erioloba*, to the extent of being almost a closed forest in parts, but still associated with bushveld species like *Terminalia sericea* and *Peltophorum africanum*.

(2) *The Eastern Form of the Kalahari Thornveld*.—This is generally an open savanna of *Acacia erioloba* in tall grass, though around Schweizer-Reneke and south of the Vall River it is fairly dense

in parts; other trees and shrubs are rare. The rainfall ranges from 400-500 mm per annum falling in summer. In spite of this marginal rainfall and the loose sandiness of the soil, extensive areas have in recent years been ploughed up in the Western Transvaal. Crops are sometimes good, but meadows growing amongst camelthorn trees are ecologically a startling and alarming sight. In the Vryburg division, ancient cultivation has, over large areas, practically removed the trees, leaving what is virtually grassveld, often dotted with *Grewia flava* and stunted *Diospyros pallens*. The only tree of general occurrence and importance is *Acacia erioloba*.

In the grassveld constituent of this veld, the following are of general occurrence:—

<i>Eragrostis lemanniana</i> .....	89 489	<i>Triraphis andropogonoides</i>	2 614
<i>Anthephora pubescens</i> .....	71 680	<i>Cyperus margaritaceus</i> ....	2 560
<i>Themeda triandra</i> ..	63 496	<i>Trachyandra laxa</i> .....	2 246
<i>Setaria flabellata</i> ....	51 819	var. <i>rigida</i> .....	2 246
<i>Eragrostis tricophora</i> .....	34 119	<i>Anthospermum rigidum</i> .....	2 036
<i>Aristida graciliflora</i> 24 174		<i>Aristida congesta</i> subsp. <i>congesta</i> ...	1 991
<i>Tragus koelerioides</i> 23 691		<i>Cassia mimosoides</i>	1 459
<i>Elephantorrhiza elephantina</i> .....	8 608	<i>Hibiscus microcarpus</i> .....	1 295
<i>Elionurus argenteus</i> 7 915		<i>Rhynchosia adenodes</i> .....	474
<i>Eragrostis pallens</i> ..	7 603	<i>Barleria macrostegia</i> .....	161
<i>Stipagrostis uniplumis</i> .....	4 962	<i>Eragrostis gummiflua</i> .....	46
<i>Pogonarthria squarrosa</i> .....	3 951	<i>Tephrosia lupinifolia</i> .....	13
<i>Hermannia tomentosa</i> .....	3 174	<i>Boophane disticha</i> .	1
<i>Cymbopogon plurinodis</i> .....	3 087		
<i>Indigofera daleoides</i> .....	2 716		

Of less general occurrence are:—

<i>Cynodon dactylon</i> .....	34 280	<i>Helichrysum caespititium</i> .....	700
<i>Aristida diffusa</i> var. <i>burkei</i> .....	7 367	<i>Bolusia capensis</i> ...	641
<i>Helichrysum paronychioides</i> ...	7 079	<i>Kyllinga alba</i> .....	641
<i>Aristida mollissima</i> 6 319		<i>Helichrysum zeyheri</i> .....	619
<i>Schmidtia pappophoroidea</i> ..	5 754	<i>Bulbostylis burchellii</i> .....	204
<i>Eragrostis superba</i> ..	3 670	<i>Fimbristylis exilis</i> ..	204
<i>Nolletia ciliaris</i> .....	2 446	<i>Stachys spathulata</i> ..	204
<i>Tephrosia sphaeropserma</i> ...	1 713	<i>Plinthus sericeus</i> ..	92
<i>Cassia nigrescens</i> ...	935	<i>Aristida meridionalis</i> ....	84
<i>Acanthosicyos naudiniana</i> .....	882	<i>Dieoma sehinzii</i> ....	71
<i>Eragrostis chloromelas</i> ....	853	<i>Sericorema remotiflora</i> ....	66
<i>Trichoneura grandiglumis</i> ....	852	<i>Tristachya rehmannii</i> .....	58

and many more, the total number of species in the Relative Abundance Table being 199. This veld, therefore, is sparse, but the tufts are large.

(3) *The Central Form of the Kalahari Thornveld*.—(See Hutchinson, p. 412). In this case the rainfall is only about 400 mm per annum, so the veld has not been disturbed by ploughing. The "purple" grasses of the Dry *Cymbopogon-Themedea* veld have fallen out, except *Themedea*, and been replaced by the "white" grasses of the Kalahari. *Themedea*, however, is the natural dominant, which mainly distinguishes this form from the western form, even though it is to be found to-day, as dominant, only on exceptionally well-cared for farms. Further overgrazing will in turn cause the "white" grasses to be replaced entirely by a uniform growth of *Schmidtia pappophoroidea*; this change can happen quite suddenly, in a few years. *Pentzia incana* and *Chrysocoma tenuifolia* are steadily invading, and to-day these Karoo bushes will be more important than they were 14 years ago when most of the data about this veld were collected.

Trees and shrubs of general occurrence are:—

Acacia tortilis	Ziziphus mucronata	140
subsp.	Acacia giraffae.....	124
heteracantha.....	A. mellifera subsp.	
1 724	detinens.....	51
Lycium oxycladum	Asparagus laricinus	9
1 620	Acacia hebeclada	
Diospyros pallens..	subsp. hebeclada.	7
207	Ehretia rigida.....	5
Rhus ciliata.....		
203		
Grewia flava.....		
178		
Lycium hirsutum...		
171		
Tarchonanthus		
camphoratus var.		
litakunensis.....		
		156

The large size of *Acacia erioloba* makes it the dominant.

Of general occurrence in the grassveld constituent are:—

Eragrostis	Hermannia comosa	4 509
lehmanniana.....	Hibiscus	
57 600	marlothianus....	4 362
Schmidtia	Hermannia	
pappophoroidea..	tomentosa.....	2 761
29 646	Rhynchosia confusa	2 746
Eragrostis	Acanthosicyos	
tricophora.....	naudiniana.....	2 316
23 106	Aristida graciliflora	1 992
Heliotropium	Aristida	
ciliatum.....	meridionalis....	1 857
20 840	Nolletia ciliaris....	1 517
Stipagrostis	Gazania krebsiana	
uniplumis.....	subsp. krebsiana.	1 377
17 043	Antizoma	
Cassia nigrescens..	angustifolia.....	1 359
16 202	Peliostomum	
Aristida congesta	leucorrhizum....	1 339
subsp. barbicollis	Sericrema	
11 740	remotiflora.....	1 208
Elephantorrhiza	Salvia clandestina	
elephantina.....	var. angustifolia..	1 168
10 478	Eragrostis obtusa..	1 094
Gnidia polycephalia	Aptosimum	
9 757	marlothii.....	1 077
Anthephora	Solanum supinum..	898
pubescens.....	Pollichia campestris	725
Aristida congesta	Cynodon	
subsp. congesta..	incompletus....	618
6 603	Othonna pallens...	592
Pentzia incana....	Geigeria ornativa....	448
6 368	Pentzia viridis....	428
Pogonarthria		
squarrosa.....		
6 301		
Dicoma schinzii....		
6 241		
Harpagophytum		
procumbens.....		
5 899		
Themeda triandra..		
5 180		
Aristida diffusa		
var. burkei.....		
4 827		
Commelina		
africana.....		
4 674		
Chrysocoma		
tenuifolia.....		
4 554		

and many more, a rich flora, with the forbs and annuals playing an important part. The cover, however, is sparse, the grasses being tall and tufted.

*Geigeria ornativa* is relatively scarce; other poisonous plants, which may be locally common, include *Geigeria brevifolia*, *G. obtusifolia* and *Urginea sanguinea*. The total number of species in the Relative Abundance Table is 270.

#### (4) The Western Form of the Kalahari Thornveld.

—(See King, Fig. 138.) This, the typical form, is an extremely open savanna of *Acacia erioloba* and *A. haematoxylon*, except along rivers and near ranges of hills and mountains, where besides greater quantities of these two species, *Boscia albitrunca*, *Grewia flava*, *Lycium hirsutum* and *Rhigozum trichotomum* are important (Fig. 30). The grasses are tufted and entirely of the "white" type, mostly *Aristida* spp. and *Eragrostis* spp. with the silvery *Stipagrostis uniplumis* conspicuous. On dunes and in valleys, *Stipagrostis namaquensis*, *Asthenatherum glaucum*, *Monechma incanum* and *Crotalaria virgultalis* may be important. In the southern part of this veld type, in Gordonia, outcrops of calcareous tufts and silcrete are occupied by Arid Karoo or Orange River Broken Veld, while in the valleys of the Langeberg and parallel ranges of hills there is in parts, a strong invasion by *Eriocephalus ericoides*, resulting in a Karoo very similar to that of sandy patches in the Central Upper Karoo and False Karoo. The annual *Schmidtia kalihariensis* is sometimes extremely abundant in tramped-out areas after good rains; and the poisonous *Dipcadi glaucum* is common in parts along the foot of the Langeberg.

The sparse tuftedness of the grass and the looseness of the virtually bottomless sand, make this veld extremely vulnerable to grazing pressure, and it is indeed fortunate that the absence of surface water has kept it so largely uninhabited.

A well developed example of this veld is that at Witsand, where it varies from a dense growth of *Acacia haematoxylon* to an open growth of large *A. erioloba*; unfortunately the grass had been grazed to extinction. Another good sample occurs as an outlier in the angle between the Vaal and Riet rivers in Kimberley division, and there are others in valleys of the Asbestos Hills, e.g. south-west of Griquatown.



FIG. 30.—Kalahari Thornveld (16) in the Kalahari Gemsbok National Park. The grass in the foreground is *Stipagrostis amabilis*, the trees are *Acacia erioloba* and *Boscia albitrunca* and the shrubs *Acacia hebeclada*, *A. mellifera* subsp. *detinens* and *Rhigozum trichotomum*.

### (b) Vryburg Shrub Bushveld

This veld type occurs on rocky soil and covers most of Griqualand West and much of the southern part of Vryburg and Kuruman divisions. It has at least four subdivisions:

(1) The *Tarchonanthus* veld of the Kaap Plateau, with many minor variations.

(2) The mixed *Tarchonanthus* veld of the Asbestos and Kuruman Hills.

(3) The mixed *Tarchonanthus-Rhus-Croton* veld of the Langeberg.

(4) The mixed *Tarchonanthus*-thorn veld of the Kimberley plains and koppies.

Each of these variations shows minor variations, both from south to north, from the edge of the dry valley of the Orange River to the wetter country northwards, and from geological formation to geological formation. Some of these variations will certainly have to be separated as distinct veld types; but the geological structure of Griqualand West and the surrounding divisions is so complex that the mapping of them would be a very lengthy procedure.

In general this veld type is a fairly dense bushveld composed of shrubs, and sometimes small trees, in a mixed grassveld. The principal shrub all through is *Tarchonanthus camphoratus* var. *litakunensis*, associated with the following (and other) species:—

Olea africana	Grewia flava
Acacia tortilis subsp. heteracantha	Boscia albitrunca
<i>Tarchonanthus</i> minor	Maytenus heterophylla
Rhus ciliata	Rhigozum obovatum
R. ciliata forma	R. trichotomum
R. pyroides	Ehretia rigida
R. lancea	Ziziphus mucronata
R. undulata var. tricrenata	Acacia karroo
R. dregeana	A. mellifera subsp. <i>detinens</i>
Euclea crispa var. ovata	Croton gratissimus
Diospyros pallens	Buddleia saligna
	Lebeckia macrantha

The grass is by nature tall, dominated by *The meda triandra* and *Cynopogon plurinodis*, with much *Aristida diffusa* var. *burkei*, *Stipagrostis uniplumis* vars., *Eragrostis lehmanniana*, *Eustachys mutica*, *Heteropogon contortus*, *Chrysopogon serulatus* and *Digitaria eriantha*; but by the process of deliberate overgrazing known as "maktrap", it

has been broken down to *Aristida diffusa* var. *burkei*, *Eragrostis lehmanniana*, *Aristida congesta* subsp. *congesta*, *A. barbicollis* and *Enneapogon desvauxii*, sometimes even to *Enneapogon* alone, which has permitted the Karoo to invade from the south and to increase. Although this change may be considered desirable for the sort of sheep farming practised, the accompanying increase in the poisonous *Geigeria ornivata* and *Oriothoglossum viride* is undesirable from any point of view. The Karoo invasion is proceeding rapidly and is sometimes accompanied by the development of thickets of less valuable shrubs and trees like *Rhus ciliata*, *Acacia mellifera* subsp. *detinens* and *A. tortilis* subsp. *heteracantha*, while valuable fodder-shrubs like *Tarchonanthus minor* are suffering the usual fate of useful plants—being killed out. *Aloe grandidentata* sometimes becomes common.

So much information has been collected about this veld type and its variations that it cannot be handled in a hurry; at this stage, therefore, they will be described only in general terms. It is typically the veld of Griqualand West, but extends well into Taung, Vryburg and Kuruman divisions, especially along the Kuruman Hills and the Langeberg and Korannaberg; it does not cross the Orange River and extends only a short distance eastwards into the Western Free State and Western Transvaal.

(1) *Tarchonanthus-Veld of the Kaap Plateau*.—The Kaap Plateau is very flat, sloping gently up from 1 250 m along the well marked escarpment in the east to c. 1 450 m along the foot of the Asbestos Hills in the west. The rainfall, coming in summer, ranges from 250 mm in the south to c. 450 mm in the north, but is very erratic. In summer, the climate is hot, in winter, very frosty. This veld type has three main variations:—

(i) Dense *Tarchonanthus* Veld on the calcareous tufa which covers most of the dolomite of which the Kaap Plateau consists (Fig. 31). Associated with the dominant *Tarchonanthus camphoratus* var. *litakunensis* are: *Rhus ciliata*, *R. pyroides*, *R. lancea*, *R. ciliata* forma, *Diospyros austro-africana* var. *microphylla*, *Diospyros pallens* and *Euclea crispa* var. *ovata*, scattered or growing together in bush clumps. (See Hutchinson, p. 417, facing p. 481; King, Figs. 269, 270; Adamson, Photo 12.)

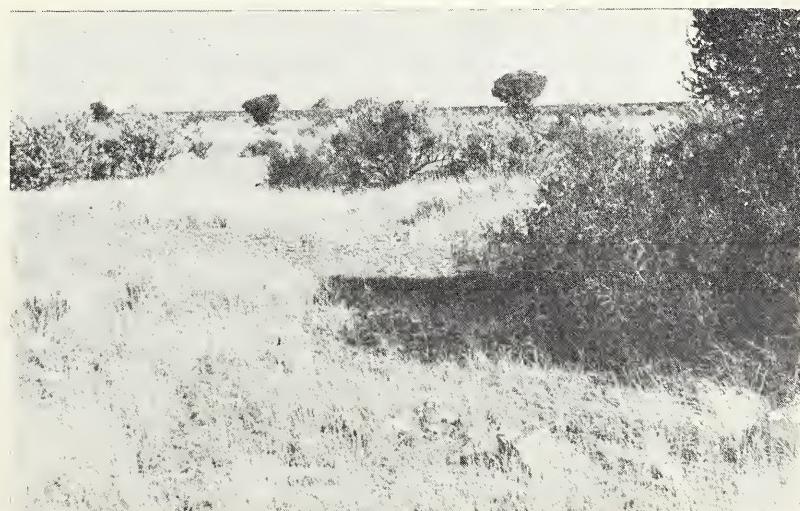


FIG. 31.—*Tarchonanthus* Veld 16b(1) of the Kaap Plateau. Species present: *Tarchonanthus camphoratus* var. *litakunensis*, *Rhus* spp., *Diospyros pallens* and *Euclea crispa* var. *ovata*.

In parts this veld is more open and dominated by *Olea africana*, forming a parkland. On the low dykes (are) of more crumbly tufa than the generally slabby tufa of the flats, and at the edges of the numerous and remarkable large and small pans and shallow drainage channels, *Themeda* has persisted better than elsewhere; while the presence of underground water in such places permits the growth of *Acacia karroo* and *Rhus lancea*. Here and there on an unoccupied or well managed farm one can find a pan that shows traces of a tall growth of *Themeda triandra*, *Miscanthidium sorghum* and sedges around its margin, with an interesting zonation of smaller plants towards the middle, suggesting that the grazing potentialities of these pans are far greater than the usual present day expanse of glaring white calcerous clay and gravel would lead one to suppose.

What little soil there is on the tufa is of a black, turf nature, and this form of the Vryburg shrub bushveld is the sweetest, such grasses as *Digitaria*, *Chrysopogon* and *Eustachys* finding a safe refuge in the crevices between the slabs of tufa. On the other hand, *Geigeria ornativa* is here the most abundant, a stunted form which is reputed to be the most dangerous to sheep. Here and there one gets the impression that the turf soil may once have formed a continuous cover over the tufa; but, if so, it has disappeared with surprising completeness.

(ii) *Open Tarchonanthus-Rhus ciliata Veld* on dolomite, which is usually covered with a layer of dark brown sandy soil or of red sand and acid gravel. The grass in this variation is of a coarser, wirier and more tufted nature and tramps out readily to *Aristida* spp., and the bush is more open. It occurs scattered over the Kaap Plateau, but is most extensive along the eastern foot of the Asbestos Hills, merging northwards into the eastern form of the Kalahari Thornveld. (See Hutchinson, p. 413.)

(iii) *Dense Mixed Shrub Bushveld* along the eastern edge of the plateau on bare dolomite, and on the rugged escarpment itself. Besides the trees and shrubs mentioned above, the following occur: *Celtis africana*, *Ficus ingens* (its white trunk often pressed flat against the face of a krantz), *Buddleia saligna*, *Nuxia gracilis*, *Nymania capensis*, *Asparagus retrofractus*, *Maytenus undata* and *Cadaba aphylla*, with the bushy *Salvia namaensis*, *Senecio longiflorus* and *Melianthus comosus*; while such succulents as *Aloe hereroensis*, *Cotyledon decussata* and *Kalanchoe pyramidalis* are sometimes conspicuous. *Cenchrus ciliaris* is the dominant grass, with much *Sporobolus fimbriatus*, *Chrysopogon*, *Cymbopogon plurinodus*, *Aristida diffusa* var. *burkei*, *Digitaria eriantha*, *Eragrostis lehmanniana*, *Heteropogon contortus* and *Fingerhuthia africana*. Thickets of *Acacia mellifera* subsp. *detinens*, *A. tortilis* subsp. *heteracantha* and *A. karroo* tend to form. Groves of fine, tall *Acacia karroo* occur around some of the fountains. (See Hutchinson, p. 432.)

(2) *Mixed Tarchonanthus Veld of the Asbestos and Kuruman Hills*.—(See Hutchinson, p. 412.) This occurs on the acid banded ironstone and Ongeluk lava of the hills, clinking stony country, and has a very rich flora: as has been mentioned (p. 11), a single list contained no less than 302

species. It is dominated by *Tarchonanthus minor*, rather than by *T. camphoratus* var. *litakunensis*, together with the following:—

<i>Olea africana</i>	<i>Rhus undulata</i> var.
<i>Rhus ciliata</i>	<i>tricrenata</i> (especially southwards)
<i>R. dregeana</i>	<i>Euclea undulata</i> (especially southwards)
<i>Lebeckia macrantha</i>	<i>Rhigozum obovatum</i>
<i>Euclea crispa</i> var. <i>ovata</i>	<i>Maytenus heterophylla</i>
<i>Rhigozum obovatum</i>	<i>Putterlickia pyracantha</i>
<i>Maytenus heterophylla</i>	(especially southwards)
<i>Putterlickia pyracantha</i>	<i>Grewia flava</i>
	(especially southwards)

This bush is more open than that of the Plateau, sometimes very sparse, especially southwards, where *Rhus undulata* var. *tricrenata* and *R. dregeana* become the principal shrubs. Northwards, the grass is sourer, with a Bankenveld affinity, including such species as:—

<i>Schizachyrium sanguineum</i>	<i>A. schinzii</i>
<i>Diheteropogon amplexens</i>	<i>Bracharia serrata</i> var.
<i>Andropogon schirensis</i>	<i>serrata</i>

and sometimes *Hyparrhenia hirta* as well as the usual

<i>Anthephora pubescens</i>	<i>Trichoneura grandiglumis</i>
<i>Themeda triandra</i>	<i>Rhynchospernum repens</i>
<i>Heteropogon contortus</i>	<i>Eragrostis curvula</i>
<i>Eragrostis lehmanniana</i>	<i>Sporobolus fimbriatus</i>
<i>Aristida diffusa</i> var. <i>burkei</i>	<i>Cymbopogon plurinodus</i>
<i>Eustachys mutica</i>	<i>Fingerhuthia africana</i>
<i>Cymbopogon excavatus</i>	<i>Panicum staphianum</i>
<i>Elionurus argenteus</i>	<i>Schmidia pappophoroidea</i>

Southwards, *Aristida diffusa* var. *burkei*, *Eragrostis lehmanniana*, *Enneapogon scoparius* and *Fingerhuthia africana* become more important, with *Digitaria smutsii* dominant in protected places, whitening the black volcanic hills. Outliers of this veld on stony outcrops and hills in the Vryburg-Mafeking neighbourhood link it with the Bankenveld and Waterberg Sour Bushveld; while southwards, and in stony parts of the valleys between the Asbestos Hills and the Langeberg, it merges into the Orange River Broken Veld with an increase in the proportion of such species as *Acacia mellifera* subsp. *detinens*, *Rhigozum obovatum*, *R. trichotomum*, *Nymania capensis*, *Euryops multifidus*, *Lycium* spp. and *Lebeckia macrantha*, and of Karoo species such as *Pentzia incana*, *P. globosa*, *Aptosimum marlothii*, *Nestlera humilis*, *Pteronia glomerata*, *P. sp. cf. P. acuta* and *Gnidia polycephala*.

*Geigeria ornativa*, of a more luxuriant form than that of the Kaap Plateau, is often abundant on the Rooirandjies and a serious hindrance to sheep farming. There is a good deal of soil erosion in the red sandy loam of the numerous little valleys, and there is no doubt that the bare stoniness of the hills is the result of sheet-erosion, even though that same stoniness gives the vegetation a secure foothold.

(3) *Mixed Tarchonanthus-Rhus-Croton Veld of the Langeberg*.—This veld is generally similar to 16 (b) (2), though of an appalling rockiness, rather than stoniness; but on this relatively high, continuous and very steep sided, north to south trending mountain range, there is a well marked aspect difference. The western slopes, from a distance, appear to be bare rock, but actually are well covered with *Croton gratissimus*, a tree whose leaves are much the same colour as the pinkish and greenish quartzites of which the mountain is composed. Associated with *Croton* are *Euphorbia avasmontana*, *Tarchonanthus minor*, *Rhus undulata* var. *tricrenata*, *Euclea undulata*, *Sarcostemma viminale* forma and *Putterlickia pyracantha*, with *Aristida engleri*, *A. diffusa* var. *burkei* and *Heteropogon contortus* the dominant

grasses. The eastern slopes lack, as important species, *Croton*, *Euphorbia* and *Sarcostemina*, but have the other shrubs more plentifully, in a better mixed grassveld; while in the kloofs, e.g. at Bergenaarspad, is almost a forest of *Buddleia saligna*.

In this "forest" the silence of the arid regions is broken by a multitude of bird-calls.

(4) *Mixed Tarchonanthus-Thornveld*.—This variation or complex of variations, occurs in the same area as the Central form of the Kalahari Thornveld, but on hard, red, sandy loam on calcareous tufa or directly on dolerite, Ventersdorp lava and other rocks, and on rocky hills, the Kalahari Thornveld occupying the loosely sandy parts. As the name suggests, the thorns are important, especially *Acacia tortilis* subsp. *heteracantha* and *A. hebeclada* subsp. *hebeclada* together with *Tarchonanthus camphoratus* var. *litakunensis*, *Ziziphus mucronata*, *Ehretia rigida*, *Diospyros pallens*, *Rhus pyroides*, *Acacia mellifera* subsp. *detinens*, *A. karroo* and other species of shrubs and trees. On the flats the grass is of mixed type with *Themeda*, but usually reduced to *Eragrostis* spp., *Digitaria eriantha*, *Sporobolus fimbriatus*, *Stipagrostis uniplumis*, *A. diffusa* var. *burkei* and *A. congesta* subsp. *barbicollis*—sometimes even to a pure stand of *Aristida congesta* subsp. *barbicollis*. *Rhus ciliata* tends to develop into thickets. On the rocky hills, besides the trees and shrubs of the flats, *Buddleia saligna* and *Rhigozum obovatum* are important, with *Cenchrus ciliaris*, *Themeda triandra*, *Heteropogon contortus*, *Cymbopogon plurinodis*, *Eustachys mutica*, *Fingerhuthia africana* and *Enneapogon scoparius*, plus the grasses just mentioned. Forbs and annuals are numerous and important, but *Geigeria ornativa* is less common, even on the calcareous tufa, than it is on the Kaap Plateau.

Where the calcareous tufa is not covered with sand, the vegetation is sometimes *Tarchonanthus* veld similar to that of the Kaap Plateau; but more commonly such places are False Karoo dotted with a few big shrubs, mainly *Diospyros pallens*, probably because the *Tarchonanthus* has been chopped out for firewood.

Southwards and westwards there is a transition to Orange River Broken Veld and the Karoo type of hill vegetation, while northwards there is a good transition to bushveld, starting near Barkly West on

the rocky ridge between the Harts and Vaal Rivers and continuing both along the small rocky escarpment on the east side of the Harts River, and along the scattered hills towards Potchefstroom. Eastwards, the vegetation of the widely scattered koppies of the Western Free State links this veld with the denser and more mixed bushveld of the Bloemfontein koppies and the low escarpment running north-north-east from Bloemfontein.

## 17 KALAHARI THORNVELD INVADED BY KAROO

In this region we find the grassveld constituent of the thornveld being replaced by Karoo, where it has been reduced by grazing mismanagement (Fig. 32). This Karoo invasion takes various forms:—

(1) On the deep sand of the western form of the Kalahari Thornveld *Eriocephalus ericooides* invades and *Geigeria brevifolia*, *G. obtusifolia* and *Salvia radula* thicken up.

(2) On rocky hills and on calcareous tufa, a fully mixed Karoo flora invades. The species include:—

<i>Pentzia globosa</i>	<i>Lasiocorys capensis</i>
<i>P. incana</i>	<i>Salvia clandestina</i> var. <i>angustifolia</i>
<i>Nestlera humilis</i>	<i>Stachys spathulata</i>
<i>Plinthus karrooicus</i>	<i>Asparagus stipulaceus</i>
<i>Barleria rigida</i>	<i>Limeum aethiopicum</i> subsp. <i>aethiopicum</i>
<i>Ruschia canonotata</i>	<i>Nenax microphylla</i>
<i>Salsola glabrescens</i>	<i>Thesium hystrix</i>
<i>Chrysocoma tenuifolia</i>	<i>Aptosimum marlothii</i>
<i>Felicia muricata</i>	<i>Peliostomum leucorrhizum</i>
<i>Osteospermum muricatum</i>	<i>Sutera atropurpurea</i>
<i>Peglolettia retrofracta</i>	<i>Tribulus terrestris</i>
<i>Pteronia glomerata</i>	<i>Zygophyllum microphyllum</i>
<i>Stipagrostis obtusa</i>	
<i>Enneapogon desvauxii</i>	
<i>Eragrostis bicolor</i>	

This is a fairly comprehensive list, including elements both of the Central Upper Karoo and of the Arid Karoo and Orange River Broken Veld.

(3) On the hard red sandy loam of the Kimberley area, *Chrysocoma tenuifolia* is the principal invader, while the local *Chrysocoma* sp. (=A. 6812H) thickens up.

(4) On sandy calcareous tufa, besides the Karoo bushes listed, *Othonna pallens*, *Euryops asparagoides*, *Gnidia polycarpa* and sometimes *Psilocaulon absinum* also become common.



FIG. 32.—Kalahari Thornveld invaded by Karoo (17) at Breckenridge in the Asbestos Hills, Griqualand West, Cape. Species noted: *Acacia erioloba*, *Stipagrostis obtusa*, *S. uniplumis*, *Monechma incanum*, *Chrysocoma tenuifolia*, *Acrotis leiocarpa* and *Acrotome inflata*.

## 18 MIXED BUSHVELD

Like the Vryburg Shrub Bushveld, this veld type is a more than Daedalian maze of variations and transitions. [See Hutchinson, pp. 386, 387 (Koppies), 388; facing p. 417 (Nylstroom river banks); Reynolds, Pl. 59; White, Dyer and Sloane, Figs. 1046, 1047; Marloth II, 2, Fig. 144 (Terminalia Veld).]

Within this veld type, Irvine recognizes two main variations: (1) *Combretum apiculatum* Veld. The bush consists of small trees, quite dense and sometimes almost scrub-forest. (2) Mixed *Terminalia-Dichapetalum* Veld, occupying the sandy plateau between the Matlabas and Mogol Rivers, the sandy northern, western and eastern slopes and valleys of the Waterberg, thence extending along the Crocodile-Elands valley and along the sandy ridge which bisects the Springbok Flats, with outliers at Zebediela, in the Olifants River valley in the Groblersdal district and along the northern foot of the eastern part of the Soutpansberg. The difficulties caused by the presence of *Dichapetalum cymosum* (Gifblaar) demand that this variation will have to be mapped in detail later as a separate veld type. This is rather a tree savanna, usually fairly dense and up to 10 m tall.

### (1) Combretum apiculatum Veld

In Irvine's words: "These veld types cover some 10 950 square km at an elevation of 750-1 050 m and receive a rainfall of 350-650 mm. Although the soil throughout is shallow, the latter veld type occurs on areas where the soil is very shallow indeed with impeded drainage. The underlying rocks are granite, sandstone, quartzite and shale, covered by a shallow layer of gritty yellow-grey sandy loam on ouklip."

(a) *Combretum apiculatum Veld Proper*.—"The bush is very uniform, and rather dense, *Combretum apiculatum* being dominant throughout, with a small admixture of several other bushes and trees, e.g. *Acacia caffra*, *Combretum imberbe*, *Dichrostachys cinerea* subsp. *africana*, *Grewia* spp., *Lannea discolor* and *Sclerocarya caffra*, sometimes also *Albizia anthelmintica* and *Kirkia acuminata* (Fig. 33).

Many of the grasses are sweet. The principal veld species are *Aristida congesta* subsp. *barbicollis*, *Digitaria eriantha*, *Eragrostis* sp. and *Schmidia pappophorooides*. Less abundant species are *Anthephora pubescens*, *Stipagrostis uniplumis*, *Brachiaria nigropedata*, *Eragrostis superba*, *Heteropogon contortus* and *Themeda triandra*. *Elionurus argenteus* is common in places."

(b) *Combretum-Pterocarpus Veld*.—"This veld is a dense uniform mixture of these two bushes, less varied than the *Combretum* veld and with a sourer type of grass (Fig. 34). The bush includes much *Grewia* spp. and a good deal of *Dichrostachys cinerea* subsp. *africana* and *Terminalia sericea*. The commonest grasses are *Aristida congesta* subsp. *barbicollis*, *Digitaria eriantha* and *Eragrostis* sp. cf. *E. tricophora*, with much *Anthephora pubescens*, *Aristida graciliflora*, *Brachiaria nigropedata*, *Eragrostis racemosa*, *Heteropogon contortus* and *Schmidia pappophorooides*. There is more *Elionurus* than in pure *Combretum* veld, but little *Themeda*. The soil is very shallow, the oukliп being frequently exposed on the surface of the ground."

### (2) Mixed Terminalia-Dichapetalum Veld

Irvine recognizes four variations of this veld:—

- (a) *Terminalia* Veld Proper
- (b) *Combretum-Terminalia* Veld
- (c) *Sclerocarya-Burkea* Veld
- (d) *Burkea* Veld

*Dichapetalum* occurs generally in (c) and (d), only patchily in (a) and (b). Soils are more or less sandy and are deep, on quartzites, shales, sandstones, granite and acid lavas.

#### (a) Terminalia Veld Proper

This is a more or less dense, fairly tall growth of bush on deep, loose sand, dominated by *Terminalia sericea* (up to 8 m high), *Ochna pulchra* and *Burkea africana*, with a scanty undergrowth of smaller bushes, varying in species from place to place (Fig. 35). *Grewia flava* is also important. The grass sward is inclined to be open and tufted, many of the species being coarse and wiry. The principal grasses are *Eragrostis pallens* and *Loudetia simplex* with much *Schmidia pappophorooides*, *Stipagrostis uniplumis* and *Brachiaria nigropedata*.



FIG. 33.—*Combretum apiculatum* Veld Proper 18 (1a) north of the Waterberg in the Transvaal.

FIG. 34.—*Combretum apiculatum*  
-*Pterocarpus rotundifolius*  
Veld 18 (1b) north-west of  
Vaalwater in the Transvaal.  
Species noted: *Combretum apiculatum*, *Pterocarpus rotundifolius*, *Ochna pulchra*, *Combretum zeyheri*, *Mundulea sericea*, *Terminalia brachystemma*, *Dombeya rotundifolia* etc.



FIG. 35.—*Terminalia* Veld Proper 18 (2a) at Toowoomba Research Station near Warmbaths in the Transvaal. *Terminalia sericea* is one of the dominants.

#### (b) Combretum-Terminalia Veld

"This veld type merges into *Combretum apiculatum* veld on the one hand and *Terminalia* veld on the other. It exhibits a fairly dense growth of *Burkea africana*, tall *Combretum apiculatum*, *Terminalia sericea* and *Pterocarpus rotundifolius* subsp. *rotundifolius*, with much *Grewia flava*, *G. bicolor* and other *Grewia* spp., *Boscia foetida* subsp. *rehmanniana* and *Mundulea sericea* and more scattered *Acacia nilotica* subsp. *kraussiana* (Fig. 36). The grass is dominated by *Schmidia pappophoroidea* and *Digitaria eriantha* with much *Brachiaria nigropedata*, *Eragrostis* sp. and *Aristida-diffusa* var. *burkei*. There is a good deal of the coarse, wiry, sandveld grass, *Eragrostis pallens*, where the soil is more sandy."

In both these veld types, where *Burkea africana* and *Ochna pulchra* occur together, *Dichapetalum cymosum* is likely to be present.

#### (c) Sclerocarya-Burkea Veld

"This covers some 700 square km on the deep

red sand of the lower slopes of the Waterberg between the Matlabas and Mogol Rivers. The rainfall is 450-550 mm and the altitude 900-1 050 m. The rock is quartzite, sandstone and granite. The bush is dominated by *Burkea africana* and *Sclerocarya caffra*, with much *Peltophorum africanum* and *Grewia flava*, and, less frequently, *Terminalia sericea*, *Ochna pulchra* and *Combretum apiculatum*. Much of the grass is of a coarse nature, as might be expected from the soil, the most abundant grasses being *Eragrostis pallens*, *Loudetia simplex* and *Schmidia pappophoroidea*. *Eragrostis* sp. cf. *E. tricophora*, *Aristida* sp. cf. *A. graciliflora* and *A. adscensionis* are common, while *Brachiaria nigropedata* and *Digitaria* spp. are to-day occasional, although there is reason to believe that the per cent of these grasses present used to be higher. The dangerous poisonous plant, *Dichapetalum cymosum* (gifblaar) occurs very frequently and constitutes a serious menace to stock grazing this veld."

FIG. 36.—*Combretum-Terminalia* Veld 18 (2b) between Vaalwater and Ellisras in the Transvaal. Species noted: *Combretum apiculatum*, *Terminalia sericea*, *Acacia erubescens*, *Dicrostachys cinerea* subsp. *africana*, *Diphorhynchus condylocarpon* and much *Aristida congesta* subsp. *congesta*.



#### (d) Burkea Veld

"This veld covers about 500 square km adjoining the *Sclerocarya*-veld on the north. The rainfall is 450-550 mm. The soil is deep, grey-brown sand, overlying shales, sandstones and quartzites, and the altitude is 900-1 050 m. The principal species are *Burkea africana* and *Combretum zeyheri* with much *Protea* sp. and a good deal of *Ochna pulchra* and *Sclerocarya caffra* (Fig. 37). The grass is somewhat wiry, although dominated by *Digitaria*, the principal species being *Digitaria eriantha*, *Aristida graciliflora*, *Eragrostis* sp. cf. *E. tricophora* and *Schmidtia pappophoroides*, with much *Brachiaria nigropedata*, *Loudetia simplex* and *Schizachyrium sanguineum*. *Panicum maximum* is plentiful under the trees."

#### (e) *Acacia nigrescens*-*Combretum apiculatum*-*Kirkia wilmsii* Veld.

The eastern part of the mixed bushveld, in and between Olifants and Steelpoort valleys, is of rather a different type from the rest, very mixed as regards bush and with *Kirkia wilmsii* playing an important part (Fig. 38). It may be characterized as *Acacia nigrescens* - *Combretum apiculatum*-*Kirkia wilmsii*

veld; little is known about it. Much of this country is norite (Irvine includes it in the Turf veld), and the grass tends to be of sweeter type than it does on the generally acid rocks of the rest of the mixed bushveld, but no details are available about it. In the valleys we find a dense bush showing affinities with the dense valley scrub and the Arid Lowveld; it will probably have to be separated as sweet bushveld, related to Arid Lowveld rather than to the Arid Sweet Bushveld of the Limpopo valley. Altitude ranges from 600 to 1 050 m above the sea, and rainfall from 450 to 650 mm per annum. The climate is hot.

Generally occurring shrubs and trees include:—

<i>Acacia nigrescens</i>	<i>Commiphora</i> spp.
<i>Combretum apiculatum</i>	<i>Rhus gueinzii</i> and other spp.
<i>Kirkia wilmsii</i>	<i>Olea africana</i>
<i>Sclerocarya caffra</i>	<i>Boscia foetida</i> subsp. <i>reemanniana</i>
<i>Balanites maughamii</i>	<i>Ptaeroxylon obliquum</i>
<i>Ziziphus mucronata</i>	<i>Terminalia sericea</i> (sandy parts)
<i>Schotia brachypetala</i>	<i>T. prunioides</i>
<i>Euphorbia cooperi</i>	<i>Mundulea sericea</i>
<i>E. ingens</i>	<i>Tarchonanthus camphoratus</i> var. <i>camphoratus</i>
<i>E. tirucalli</i>	
<i>E. excelsa</i> (local)	
<i>Acacia tortilis</i> subsp. <i>heteracantha</i>	



FIG. 37.—*Burkea* Veld 18 (2d) in the neighbourhood of Sandrivierspoort, Waterberg, Transvaal. Species noted: *Burkea africana*, *Ziziphus mucronata* and *Combretum imberbe*.

FIG. 38.—*Acacia nigrescens*-  
*Combretum apiculatum*-Kirkia  
*wilmsii* Veld 18 (2c) in the  
Olifants River Valley near  
Burgersfort in the eastern  
Transvaal. Apart from domi-  
nants, *Sclerocarya caffra*,  
*Euclea crispa*, *Cussonia spicata*  
and *Aristida* spp. also noted.



A. mellifera subsp. detinens  
A. erubescens  
A. senegal var. leiorhachis  
A. karroo and other spp.  
*Combretum hereroense*  
*Albizia anthelmintica*  
*Peltophorum africanum*  
Aloe spp.  
*Spirostachys africana*  
*Sterculia rogersii*

*Grewia monticola* and other  
spp.  
*Dichrostachys cinerea*  
subsp. *africana*  
*Maytenus senegalensis*  
*Cadaba terminalia*  
*Bolusanthus speciosus*  
*Croton* sp.  
*Euclea undulata*  
*Strychnos* sp.

with *Acacia tortilis* subsp. *heteracantha* dominant  
on ancient fallows, as usual.

(f) Open Sclerocarya Veld

This variation, like the *Sclerocarya-Burkea* Veld (c), is rather sourer, or at least harder, as regards its grasses, than is usual in the mixed bushveld, in spite of receiving as little as 350 mm of rain per annum in parts (Fig. 39). It occurs (i) on the gentle northern slopes of the Pietersburg Plateau, under a rainfall of 350-400 mm per annum on granite;

(ii) on the rolling granite country of the Elands River valley north of Rustenburg, under a rainfall of about 500 mm per annum.

(i) Here it occurs on wide ridges between thorn-filled valleys, and is an open savanna of small *Sclerocarya caffra* and *Peltophorum africanum* with some *Maytenus senegalensis*, *Grewia flava*, *Acacia permixta* and *Clerodendrum glabrum*, and a few other species as rareties. The grass is a curious mixture, including *Digitaria eriantha*, *Eragrostis* sp. cf., *E. tricophora*, *Themeda triandra*, *Rhynchelytrum repens*, *Pogonarthria squarrosa*, *Aristida congesta* subsp. *barbicollis*, *A. graciliflora* and *Trichoneura grandiglumis* with smaller quantities of *Andropogon schreensis*, *Schmidia pappophoroidea*, *Heteropogon contortus*, *Panicum coloratum*, *Cymbopogon plurinodus* and *Tricholaena monachne*, i.e. hard and wiry more than sour in the ordinary sense.



FIG. 39.—Open *Sclerocarya* Veld  
18 (2f) near Zebediel in the  
Transvaal. Present: *Sclerocarya*  
*caffra*, *Acacia* spp. and *Ziziphus*  
*mucronata*.

The thornveld of the shallow valleys is transitional to the Arid Sweet Bushveld; important trees and shrubs include:—

*Acacia tortilis* subsp.  
heteracantha  
*Dichrostachys cinerea*  
subsp. *africana*  
*Grewia monticola*  
*Peltophorum africanum*  
*Acacia nilotica* subsp.  
*kraussiana*

*Maytenus senegalensis*  
*Grewia flava*  
*Combretum apiculatum*  
(rare)  
*Ozoroa reticulata*  
*Commiphora mollis*  
*Ziziphus mucronata*  
*Sclerocarya caffra*

with the following grasses:—

*Heteropogon contortus*  
*Digitaria eriantha*  
*Eragrostis* sp. cf. *E.*  
tricophora  
*Cymbopogon plurinodis*

*Aristida graciliflora*  
*Schmidtia pappophoroides*  
*Brachiaria nigropedata*  
*Themeda triandra*  
*Panicum coloratum*

and others.

(ii) This variation of the Open *Sclerocarya* Veld is a good deal sourer, often on very shallow, gritty soil on oukliп. Trees and shrubs include:—

*Sclerocarya caffra*  
*Dichrostachys cinerea*  
subsp. *africana*  
*Rhus gueinzii*  
*Acacia nilotica* subsp.  
*kraussiana*

*Peltophorum africanum*  
*Euclea undulata*  
*Acacia tortilis* subsp.  
heteracantha  
*Grewia* sp.  
*Vitex zeyheri*

with, in the grassveld constituent:—

*Loudetia simplex*  
*Digitaria eriantha*  
*Anthephora pubescens*  
*Elionurus argenteus*  
*Andropogon schirensis*  
*Cymbopogon excavatus*  
*Bulbostylis burchellii*

*Brachiaria nigropedata*  
*Heteropogon contortus*  
*Eragrostis superba*  
*Brachiaria serrata* var.  
*serrata*  
*Cymbopogon plurinodis*

(g) *Dombeya rotundifolia*—*Acacia rehmanniana* Veld

These variations (e) and (f) of the Mixed Bushveld merge easily into variation (g) on the gentle western aspect of the Drakensberg ridge south of Louis Trichardt and round the northern edge of the Pietersburg Plateau. This likewise occurs on granite, and, in turn merges easily into the Sourish Mixed Bushveld of the top of the escarpment. There is a rapid decrease in rainfall from east to west, and to a lesser degree from south to north, so these veld

types form narrow, ill-defined belts. This variation (g) is a fairly dense savanna of trees and shrubs in tall, mixed grass (Fig. 40). The trees include:—

*Dombeya rotundifolia*  
*Acacia rehmanniana*  
*Balanites maughamii*  
*Peltophorum africanum*  
*Ozoroa reticulata*  
*Pappea capensis* var.  
The shrubs include:—  
*Maytenus senegalensis*  
*Ehretia rigida*  
*Ormocarpum trichocarpum*  
*Grewia monticola*  
*Maytenus heterophylla*  
*Mundulea sericea*  
*Dichrostachys cinerea*  
subsp. *africana*  
*Ziziphus mucronata*

*Acacia robusta* subsp.  
*robusta*  
*Boscia foetida* subsp.  
*rehmanniana*  
*Sclerocarya caffra*  
*Acacia tortilis* subsp.  
heteracantha  
*Combretum molle*  
*Balanites pedicellaris*  
*Grewia flava*  
*Commiphora*  
pyracanthoides  
*Acacia permixta* (important  
in patches)  
*Pterocarpus rotundifolius*  
subsp. *rotundifolius*  
*Euclea undulata*

The grassveld constituent is of normal Mixed Bushveld type, including:

*Themeda triandra*  
*Eragrostis superba*  
*Brachiaria nigropedata*  
*Urochloa* sp.  
*Sporobolus nitens*  
*Schmidtia pappophoroides*

*Panicum coloratum*  
*Bothriochloa insculpta*  
*Cymbopogon plurinodis*  
*Eragrostis* sp.  
*Heteropogon contortus*  
*Aristida graciliflora*

with *Panicum maximum* under the trees, and tramping out to:—

*Eragrostis* sp. cf. *E.*  
tricophora  
*Aristida congesta* subsp.  
*barbicollis*

*Digitaria eriantha*  
*Trichoneura grandiglumis*  
*Schmidtia pappophoroides*  
*Rhynchosperma repens*

On dome-shaped granite koppies occurring in this veld, *Euphorbia ingens* and *E. cooperi* are often conspicuous with much *Cenchrus ciliaris*.

## 19 SOURISH MIXED BUSHVELD

(See Hutchinson, p. 411; Reynolds, Pl. 31, 51, 61)

This is a rather more clearly defined veld type than is the Mixed Bushveld, occupying an irregular belt on the gentle slopes to the mountains, between the sour types (both grassveld and bushveld) and the mixed types of the plains and valleys (Fig. 41). It is generally a rather open savanna with *Acacia caffra* the dominant tree, in a fairly tall and dense grassveld dominated by *Cymbopogon plurinodis*, *Themeda triandra*, *Elionurus argenteus* and *Hyparrhenia* spp. Soils are sandy loam and rainfall ranges from 350 to 650 mm per annum.



FIG. 40.—*Dombeya rotundifolia*-*Acacia rehmanniana* Veld 18 (2g) between Pietersburg and Munnik in the Transvaal. Also present: *Acacia nebrownii*, *A. robusta* subsp. *robusta*, *Peltophorum africanum* and *Themeda triandra*.



FIG. 41.—Sourish Mixed Bushveld (19) between Maraheki and Thabazimbi in the Transvaal. Species noted: *Acacia caffra*, *A. karroo*, *A. robusta* subsp. *robusta*, *A. gerrardii* var. *gerrardii*, *Peltophorum africanum*, *Terminalia sericea*, *Aristida congesta* subsp. *congesta*, *Eragrostis tricophora* etc.

The principal trees and shrubs are:—

<i>Acacia caffra</i>	<i>Pappea capensis</i> var.
<i>A. karroo</i>	<i>Dichrostachys cinerea</i>
<i>A. robusta</i> subsp. <i>robusta</i>	subsp. <i>africana</i>
<i>A. tortilis</i> subsp.	<i>Dombeya rotundifolia</i>
<i>heteracantha</i>	<i>Combretum zeyheri</i>
<i>Rhus guineensis</i>	<i>Sclerocarya caffra</i>
<i>Grewia</i> spp.	<i>Ziziphus mucronata</i>
<i>Peltophorum africanum</i>	<i>Burkea africana</i>
<i>Acacia gerrardii</i> var.	
<i>gerrardii</i>	

The principal grasses are:—

<i>Cymbopogon plurinodis</i>	<i>Brachiaria nigropedata</i>
<i>Themeda triandra</i>	<i>Anthepphor pubescens</i>
<i>Elionurus argenteus</i>	<i>Aristida graciliflora</i>
<i>Heteropogon contortus</i>	<i>Panicum maximum</i> (under
<i>Aristida canescens</i>	trees)
<i>Eragrotis superba</i>	

breaking down to *Eragrostis* sp. cf. *E. tricophora*, *Digitaria eriantha* and *Aristida congesta* subsp. *barbicollis*.

The north-eastern part of this veld type, north of the Chunes mountains on granite, differs in having wirier grasses. Besides those mentioned as being typical, the following are important:—

<i>Eragrostis</i> sp. cf. <i>E. heteromera</i>	<i>Schizachyrium sanguineum</i>
<i>Pogonarthria squarrosa</i>	<i>Sporobolus stapfianus</i>
<i>Trichoneura grandiglumis</i>	<i>Allotropis semialata</i>
<i>Setaria</i> sp.	<i>Tristachya hispida</i>
<i>Eragrostis chloromelas</i>	<i>Loudetia simplex</i>
<i>Diheteropogon amplexens</i>	<i>Digitaria monodactyla</i>
<i>Trachypogon spicatus</i>	<i>Andropogon</i> sp.
<i>Triraphis andropogonoides</i>	<i>Eragrostis gummiflua</i>

There is a suggestion of the North-eastern Mountain Sourveld about this mixture, but it is still bushveld, with the following trees and shrubs:—

<i>Acacia caffra</i>	<i>Ficus natalensis</i>
<i>Combretum molle</i>	<i>Acacia robusta</i> subsp.
<i>Acacia</i> sp.	<i>robusta</i>
<i>Dombeya rotundifolia</i>	<i>Schotia brachypetala</i>
<i>Peltophorum africanum</i>	<i>Acacia davyi</i>
<i>Euphorbia ingens</i>	<i>Dovyalis zeyheri</i>
<i>Acacia karroo</i>	<i>Ormocarpum</i>
<i>A. gerrardii</i> var. <i>gerrardii</i>	<i>trichocarpum</i>
<i>A. burkei</i>	<i>Diospyros lycioides</i> subsp.
<i>A. permixta</i>	<i>sericea</i>
<i>Faurea saligna</i>	<i>Carissa bispinosa</i>
<i>Maytenus senegalensis</i>	

and many more. In the gaps in the Drakensberg between the Chunes Mountains and the Soutpansberg, the North-eastern Mountain Sourveld is not developed at all; here this form of the Sourish Mixed Bushveld merges directly into the Lowveld Sour Bushveld of the eastern escarpment via a narrow belt, just at the edge of the escarpment, of *Faurea saligna* Veld, which is not quite that of the Waterberg, too narrow to map, and best included in the Sourish Mixed Bushveld.

South of the Chunes Mountains, this veld type, like the Mixed Bushveld in this part, includes a good deal of *Kirkia wilmsii*.

## 20 SOUR BUSHVELD

(See Taljaard, Photos 73, 76, 77; Hutchinson, facing pp. 416, 417)

This is the veld of the bushveld mountains, the Waterberg having the biggest area of it. It is an open savanna of tall straight *Faurea saligna* trees in a tall, tufted, wiry, sour grassveld in the less rocky parts, a dense, mixed bushveld in the rugged parts (Fig. 42). It is beautiful country, but hot in spite of its altitude of 1 200-1 500 m above sea-level. On the quartzite, sandstone and shale of most of these mountains, the soil is of a sandy, bubbly nature, very poor and sour. Rainfall ranges from 650 to 900 mm per annum, falling in summer.

Typical trees and shrubs include:—

<i>Faurea saligna</i>	<i>Kirkia wilmsii</i>
<i>Acacia caffra</i>	<i>Croton gratissimus</i>
<i>Protea caffra</i>	<i>Ficus natalensis</i>
<i>Bequaertioidendron</i>	<i>F. soldanella</i>
<i>magalismontanum</i>	<i>F. ingens</i>
<i>Dombeya rotundifolia</i>	<i>Elephantorrhiza burkei</i>
<i>Lannea discolor</i>	<i>Bridelia mollis</i>
<i>Vangueria infausta</i>	<i>Ochna pulchra</i>
<i>Combretum molle</i>	<i>Strychnos pungens</i>
<i>C. zeyheri</i>	<i>Maytenus tenuispina</i>
<i>C. hereroense</i>	<i>Nuxia congesta</i>
<i>C. apiculatum</i>	<i>Tapiphyllum parvifolium</i>
<i>Rhus zeyheri</i>	<i>Brachylaena rotundata</i>
<i>Dovyalis zeyheri</i>	<i>Cassine burkeana</i>
<i>Berchemia zeyheri</i>	<i>Osyris lanceolata</i>
<i>Euclea crispa</i> var. <i>crispa</i>	

FIG. 42.—Sour Bushveld (20) at Gemsbokfontein, Waterberg, Transvaal. Species noted: *Faurea saligna*, *Combretum zeyheri*, *Acacia caffra*, *Burkea africana*, *Hyperthelia dissoluta*, *Diheteropogon amplexens*, *Schizachyrium sanguineum* and *Loudetia simplex*.



*Grewia* spp.  
*Burkea africana*  
*Gardenia spatulifolia*  
*Olea africana*  
*Diplorhynchus condylocarpon*  
and many more.

In patches on the slopes, on termitaria, and in sheltered kloofs (especially of the Magaliesberg), patches of near-forest develop. The principal species are:—

*Mimusops zeyheri*  
*Clerodendrum glabrum*  
*Dovyalis zeyheri*  
*Celtis africana*  
*Chaetacme aristata*  
*Euclea crispa* var. *crispa*  
*Grewia occidentalis*  
*G. monticola* and other spp.

plus

*Rauvolfia caffra*  
*Halleria lucida*  
*Tricalysia lanceolata*  
*Apodites dimidiata*  
*Buddleia saligna*  
*Trema orientalis*

in the kloofs.

Along the rocky valleys, a thornveld composed of *Acacia caffra* is typical.

The grassveld constituent is a rich one floristically even if peculiarly useless for grazing, at least in its present condition. It is probable, however, that a wasteful combination of burning and selective grazing is largely responsible for this uselessness, through reducing the proportion of such useful grasses as *Themeda*. The principal species are:—

*Schizachyrium sanguineum*  
*S. jeffreyi*  
*Elinurus argenteus*  
*Setaria lindenbergtiana*  
(rocky places)  
*Loudetia simplex*  
*Diheteropogon amplexens*  
*Hyperthelia dissoluta*  
*Trachypogon spicatus*  
*Panicum natalense*  
*Brachiaria nigropedata*  
*Eragrostis curvula*  
*E. superba*  
*E. nindensis*  
*Themeda triandra*  
*Sporobolus pectinatus*

*Pachystigma triflorum*  
*Pseudolachnostylis maprouneifolia*  
*Albizia tanganyicensis*

*Ficus natalensis*  
*F. pretoriae*  
*Carissa bispinosa*  
*Sclopia zeyheri*  
*Cassine burkeana*  
*Euphorbia ingens*  
*Acalypha glabrata* var.  
*pilosior*

*Ilex mitis*  
*Pittosporum viridisflorum*  
*Rhus transvaalensis*  
*Rhoicissus* sp.  
*Syzygium cordatum*

and many more, with a great wealth of forbs and bushy plants, including a few stragglers of the southern flora, e.g. *Cliffortia linearifolia*, *Pegoletia tenuifolia*, *Helichrysum kraussii* and *Erica drakensbergensis*, besides the important *Faurea saligna* and *Protea caffra*.

This veld is closely related to the more mountainous parts of the Lowveld Sour Bushveld, but is drier, less hot (especially in winter), and has not a general forest climax.

### IIIA FALSE BUSHVELD TYPES

#### 21 FALSE THORNVELD OF EASTERN CAPE

This veld type, on the undulating country along the foot of the mountains from Debe Nek to Somerset East, ranges to-day from Eastern Province Grassveld thickly sprinkled with dwarf *Acacia karroo* (thorn tree) to a dense, clumpy shrub bushveld indistinguishable from the upper margin of the Valley Bushveld, and even to a False Karroid Broken Veld (Fig. 43). Rainfall ranges from about 400-650 mm per annum.

The vegetation of the ridges and plains is to be visualized as having been originally either Eastern Province Grassveld (as parts are to-day), or scrub-forest marginal to the high forest of the mountains, and separated from the Valley Bushveld by a zone of grassy thorn and bushclump-veld along the edges of the valleys. This zone would have been narrow along the steeper sided valleys, e.g. south of Alice, wide in the shallower valleys, e.g. south of Adelaide and Somerset East. The pattern of the vegetation below the mountains in this part is thus visualized as having been similar to that of the vegetation below the Drakensberg in the Transkei and Natal. There is no place for Karoo in this pattern.

It is this thorn-bushclump veld which is invading the grassveld and by reducing the grass cover and assisting erosion, is opening the way for the spread both of the less mesophytic Valley Bushveld and of the Central Lower Karoo, an alien to these parts. The result is False Karroid Broken Veld, an extremely poor substitute for the short, dense grassveld which belongs here.

*Heteropogon contortus*  
*Microchloa caffra*  
*Digitaria eriantha*  
*Aristida diffusa* var. *burkei*  
*A. transvaalensis*  
*A. spectabilis*  
*Pogonarthria squarrosa*  
*Diplachne biflora*  
*Rhynchosperma setifolium*  
*R. repens* (old lands)  
*Panicum maximum* (under trees)  
*Enneapogon pretoriensis*  
*Urelytrum squarrosum*  
*Setaria perennis*

FIG. 43.—False Thornveld of Eastern Cape (21) in the valley of the Tyumie River near Woburn. The main constituent is *Acacia karroo*. In the foreground is Valley Bushveld Proper, southern variation (23b), with the following composition: *Euphorbia triangularis*, *Cussonia spicata*, *Scutia myrtina*, *Capparis sepiaria* var. *citrifolia*, *Plumbago auriculata*, *Euclea undulata*, *Schotia afra* var. *afra* etc.



Where the Eastern Province Grassveld still retains its dense *Themeda* sward, the thorn tree does not invade. When the sward has been broken down, by selective grazing, to the taller, more tufted *Digitaria-Sporobolus* stage, the thorn trees invade, not gradually, but in leaps. Apparently the seed, which is distributed by grazing animals, lies dormant until conditions suitable for its germination occur. Then seedlings either suffer mass mortality or survive in fair quantity and large areas become covered with little thorn trees all of the same size. Under some of them, bird-distributed shrubs, notably *Scutia myrtina*, establish themselves and grow into bush clumps. As these increase in size and develop their undergrowth of sweet *Panicum* spp., bare patches develop around them, both as a consequence of concentration of uncontrolled grazing and of direct competition with the grass. Then the surface soil becomes eroded away and gradually all trace of the original *Cymbopogon-Themeda* Veld disappears. On the eroded soil it returns with difficulty, even if the bush is chopped out, but it can be assisted by spreading the chopped bush over the bare surfaces, by reseeding and by resting the veld. Where erosion has not occurred, clearing of the bush will result in immediate recovery of the grass, even though reseeding to such species as *Themeda* and *Panicum stapfianum* may still be necessary to raise the succsion beyond the *Digitaria-Sporobolus* stage.

Under conditions of excessive grazing pressure, the thorn tree invasion may be very dense and erosion may result at once. In all cases Karoo tends to invade, especially along the drier southern and western edges of the area; sometimes, also, *Berkheya* sp. and *Exomis microphylla* var. *microphylla* become common. The Karoo is of Lower Central type, mainly *Pentzia incana* (*ankerkaro*), *Asparagus striatus*, *Indigofera sessilifolia*, *Hermannia incana*, *Aster* sp. (=A. 12598), *Becium burchellianum* (in rocky places) *Selago triquetra* and *Eberlanzia vulnerans*. Along the foot of the mountains, where rainfall is higher, *Chrysocoma tenuifolia* is the prineipal Karoo invader, sometimes with *Selago corymbosa* and *Felicia filifolia*, and rarely with *Pteronia incana*.

It is anticipated that Story will soon be able to throw light on this puzzling problem of thorn encroachment.

A typical sample of this false thornveld will have the following trees and shrubs, mostly in the bush clumps:—

<i>Acacia karroo</i>	<i>Cussonia spicata</i>
<i>Scutia myrtina</i>	<i>Grewia occidentalis</i>
<i>Capparis sepiaria</i> var. <i>citrifolia</i>	<i>Rhus longispina</i>
<i>Maytenus polycanthus</i>	<i>Cassine aethiopica</i>
<i>M. capitatus</i>	<i>C. papillosa</i>
<i>Ehretia rigida</i>	<i>Olea africana</i>
<i>Carissa haematoxarpa</i>	<i>Ptaeroxylon obliquum</i>
<i>Allophylus decipiens</i>	<i>Capparis oleoides</i>
<i>Azima tetracantha</i>	<i>Schotia latifolia</i>
<i>Sideroxylon inerme</i>	<i>Hippobromus pauciflorus</i>
<i>Buddleia saligna</i>	<i>Brachylaena ilicifolia</i>
	<i>Canthium ventosum</i>

Such species as *Buddleia saligna*, *Cussonia spicata*, *Grewia occidentalis*, *Cassine* spp., *Hippobromus* and *Canthium ventosum* are perhaps relics of the old scrub forest.

The grassveld constituent of the sample will include:—

<i>Sporobolus fimbriatus</i>	<i>Panicum stapfianum</i>
<i>Digitaria eriantha</i>	<i>Heteropogon contortus</i>
<i>Eragrostis curvula</i>	<i>Setaria flabellata</i>
<i>E. obtusa</i>	<i>Eustachys mutica</i>
<i>Cymbopogon plurinodis</i>	<i>Aristida congesta</i> subsp. <i>congesta</i>
<i>Themeda triandra</i>	<i>Elionurus argenteus</i> (rarely)
<i>Eragrostis chloromelas</i>	

In the Eastern Cape, the traveller has a constant reminder of how recent can be the changes in the vegetation which we are considering, in the shape of the Sneezewood fence-posts. Trees of a size to be split into such fence-posts are rarities to-day, but the fact that they existed in that area is shown by the mouldering stumps in the forests, of a size comparable to the giant Yellow-woods, which, because they were hollow or twisted, have been permitted to survive. Such relics give us the clue that what we call high forest to-day may be little better than the scrub forest of 200 years ago.

## 22 INVASION OF GRASSVELD BY THORN

This invasion, occurring mainly in the drainage basin of the White and Black Kei rivers, is rather different, taking place in an area where the climax is the south-eastern variation of the Dry *Cymbopogon-Themeda* Veld, and where conditions are too far unsuitable for the Valley Bushveld to permit it to follow the thorns, even when climatic conditions have deteriorated (Fig. 44). As has been

FIG. 44.—Invasion of Grassveld by Thorn (22) at Bolo in the eastern Cape. Species noted: *Acacia karroo*, *Themeda triandra*, *Cymbopogon plurinodis* and *Eragrostis chloromelas*.



mentioned (p. 8), *Acacia karroo* is also invading the sourveld of the Transkei along the river valleys, but this invasion is on a small scale. The spread of *Acacia caffra* up the valleys in Natal, e.g. the Bushmans River valley in the neighbourhood of Estcourt, is rather the same thing as the spread of *A. karroo* in the Eastern Province Grassveld, pioneering an advance of the Valley Bushveld.

In the Kei basin, the only tree involved is *Acacia karroo*, which usually remains scattered and grows to a good size. Although fresh establishment of thorns occurs at intervals, only in the river valleys and along the foot of the mountains do they become dense enough to shade out the grass and cause soil erosion, by bringing about concentration of grazing pressure on the sweeter and more palatable vegetation that develops under them. Around Tarkastad are some very good demonstrations of the bearing of veld management on thorn tree encroachment—on one side of a fence a hillside will be a dense thicket of thorns, whereas on the other side it will be clear grassveld. The same thing may be seen on the mountain slopes in the Koonap valley north of Adelaide.

Karoo invasion has already penetrated the mountain barrier along the western side of the Black Kei basin, so that a false karroid broken veld is likely to develop here during the next decade or two.

It is perhaps significant that if the average maximum and minimum temperatures for Queenstown are plotted, it will be found that, although the maximum temperature has scarcely risen at all since 1872, when the record starts, the minimum has risen appreciably. If the map of the distribution of *Acacia karroo* is studied, it will be seen that this species avoids only the frostiest parts of the Republic.

#### IV KAROO AND KARROID TYPES

##### 23 THE VALLEY BUSHVELD

As the name implies, this veld type is found in the valleys of the numerous rivers, mostly draining into the Indian Ocean. These valleys are hot and receive less rain than the intervening ridges, from 500-900 mm per annum. In the case of the Great Fish and Sundays River valleys, which have wide,

flat, dry bottoms, the Valley Bushveld proper occurs as narrow belts on the steep, less arid sides of the valleys, particularly on the northern sides.

It can be subdivided as follows:—

- (a) Valley Bushveld proper, northern variation, extending as far south as the Great Kei Valley;
- (b) Valley Bushveld proper, southern variation, from the Great Kei to the Kabeljauw's Valley;
- (c) The Fish River Scrub, in the Lower Great Fish River valley;
- (d) (i) The Addo Bush and  
 (ii) The Sundays River Scrub, in the wide, flat Lower Sunday's River Valley;
- (e) The Gouritz River Scrub.

##### (a) Northern Variation of the Valley Bushveld

[For (a) and (b) see Marloth II, 2, Pl. 45, Fig. 92; Reynolds, Pl. 22, Fig. 455, Pl. 69 ; Pl. 51 (right) and Pl. 71 (both Marginal Thornveld); White, Dyer and Sloane, Figs. 1016, 1017, 1021, 1025, 1027, 1037, 1038, 1041]

This variation is transitional to the Lowveld, particularly from the Umkomaas Valley northwards; indeed, this part should perhaps have been separated as a sixth variation. This northern variation (Fig. 45) is rather more open than the southern variation, and includes more grass, fewer succulents and more species of definitely tropical nature, e.g. *Euphorbia ingens*, *E. tirucalli*, *Dombeya cymosa*, *Dalbergia obovata*, *Acacia nilotica* subsp. *kraussiana*, *A. robusta* subsp. *robusta*, *Ziziphus mucronata*, *Vitex rehmannii* and *Vangueria infusa*. It is also far less thorny. Fully developed Valley Bushveld is scrub forest dominated by tree *Euphorbias*, but much of it, especially in this northern variation, is scrub-forest, with few or no *Euphorbias*, or else dense savanna.

Trees and shrubs of general occurrence are:—

<i>Dombeya cymosa</i> ...	4 308	<i>Maytenus heterophylla</i> ....	210
<i>Euphorbia tirucalli</i> ...	2 859	<i>Ziziphus mucronata</i>	183
<i>Xeromphis rufida</i> ...	2 616	<i>Acacia nilotica</i>	
<i>Jasminum multipartitum</i> ...	2 551	subsp. <i>kraussiana</i>	114
<i>Dalbergia obovata</i> ...	1 628	<i>Cassine aethiopica</i> .	84
<i>Calpurnia aurea</i>		<i>Brachylaena ilicifolia</i> .....	
subsp. <i>aurea</i> ....	931		78
<i>Rhus pentheri</i> ....	911	<i>Grewia occidentalis</i>	

FIG. 45.—Valley Bushveld Proper, northern variation (23a) near Weenen in Natal. Species present: *Aloe marlothii*, *Euphorbia pseudocactus*, *Maytenus heterophylla* and *Xeromphis rufus*.



Asparagus striatus..	771	Rhoicissus	
Ehretia rigida.....	660	tridenda.....	61
Hippobromus		Acaia robusta	
pauciflorus .....	583	subsp. robusta...	43
Acacia		Schotia	
schweinfurthii		brachypetala....	34
var.		Sarcostemma	
schweinfurthii...	471	viminale.....	33
Plumbago auriculata	407	Ptaeroxylon	
Acacia karroo.....	374	obliquum.....	22
Acokanthera		Vangueria infusa...	22
oppositifolia.....	365	Cussonia spicata...	20
Capparis sepiaria		Pappea capensis...	19
var. citrifolia....	306	Senecio	
Euclea crispa var.		brachypodus....	16
crispa.....	282	Buddleia saligna...	11
Aloe spectabilis....	252	Maerua	
Euphorbia		rosmarinoides...	7
triangularis.....	242	Fagara capensis...	4
Acacia caffra.....	213		

Trees and shrubs of less general occurrence include:—

Asparagus falcatus.	762	Acalypha glabrata.	
Senecio deltoides...	632	var. pilosior....	111
Diospyros simii....	472	Jasminum	
Acacia ataxacantha	428	stenolobum....	87
Dichrostachys		Maytenus	
cinerea subsp.		heterophylla....	83
africana.....	258	Euclea schimperi	
Combretum molle..	236	var. daphnoides..	64
Spirostachys		Jasminum angulare	55
africana.....	222	Euphorbia	
Maytenus		pseudocactus....	49
polyacantha....	185	Abrus laevigatus...	42
Dioscorea		Helinus	
cotinifolia.....	181	integripolius....	33
Bauhinia natalensis	169	Canthium spinosum	28
Asparagus		Heteropyxis	
racemosus.....	167	natalensis.....	28
Rhoicissus digitata.	145		

and many more.

Smaller plants of general occurrence are:—

Hypoestes		Kalanchoe	
verticillaris.....	51 718	rotundifolia....	2 738
Themedia triandra		Achyropis	
var.....	35 155	leptostachya....	1 776
Barleria obtusa....	25 421	Eragrostis superba.	813
Peristrophe		Abutilon	
natalensis.....	15 098	sonneratianum...	709
Panicum maximum	5 264	Cyperus	
Sporobolus		albostriatus....	114
fimbriatus.....	4 228	Lantana rugosa....	108
Panicum deustum..	4 194	Viscum	
Eragrostis curvula..	3 010	rotundifolium....	21

Note the scarcity of succulents and the abundance of Acanthaceae and grasses in the undergrowth. Of less general occurrence are:—

Other Acanthaceae	12 605	Zinnia peruviana...	956
Tragia racemosus..	4 297	Cymbopogon	
Urochloa		plurinoidis.....	919
panicoidea.....	4 064	Cynodon dactylon.	808
U. pullulans.....	3 142	Aizoon glinoides...	801
Aristida congesta		Digitaria eriantha..	799
subsp. barbicollis	2 852	Diplachne eleusine...	617
Setaria chevalieri ..	2 019	Blepharis natalensis	608
Heteropogon		Hibiscus	
contortus.....	1 571	calyphyllus.....	484
Tagetes minuta....	1 161	Chaetacanthus	
Hyperhrenia sp....	1 103	setiger.....	479
Cynodon		Brachiaria	
incompletus.....	997	eruciformis.....	412
Digitaria longiflora	997	Sporobolus smutii	351

and many more, the total number of species in the Relative Abundance Table being 585.

#### (b) SOUTHERN VARIATION OF THE VALLEY BUSHVELD

In the southern variation (Fig. 46) of the Valley Bushveld, the trees and shrubs of general occurrence are:—

Scutia myrtina....	3 983	Sarcostemma	
Capparis sepiaria		viminale.....	142
var. citrifolia....	3 358	Schotia afra var.	
Rhoicissus digitata	3 145	afra.....	125
Azima tetracantha.	2 457	Chaetaeme aristata	
Secamone		Diospyros lycioides	
frutescens.....	2 162	subsp. lycioides.	117
Plumbago		Pappea capensis...	105
auriculata.....	2 008	Pelargonium	
Grewia occidentalis	899	pelatum.....	105
Euclea undulata...	840	Olea africana.....	101
Phyllanthus		Maytenus	
verrucosus.....	687	heterophylla.....	92
Ptaeroxylon		Schotia	
obliquum.....	653	brachypetala....	88
Maytenus capitata	653	S. latifolia.....	
Euphorbia		Cussonia spicata...	60
triangularis.....	572	Fagara capensis....	56
Cynanchum		Sideroxylon inerme	37
ellipticum.....	562	Asparagus	
Asparagus setaceus	536	subulatus.....	35
Xeromphis rufus...	532	Apodytes dimidiata	27
Asparagus		Jasminum angulare	24
africanus.....	508	Scolopia zeyheri...	15
Allophylus		Hippobromus	
decipiens.....	487	pauciflorus.....	15
Cassine aethiopica	425	caffrum.....	12
Portulacaria afra..	368		



FIG. 46.—Valley Bushveld Proper, southern variation (23b), in Buffalo Valley at East London in the Cape. Species noted: *Euphorbia triangularis*, *Cussonia spicata*, *Scutia myrtina*, *Harpephyllum caffrum*, *Euclea undulata*, *Dalbergia obovata*, *Ptaeroxylon obliquum*, *Sideroxylon inerme* and *Buxus macowanii*.

<i>Rhus refracta</i> .....	357	<i>Diospyros scabrida</i>	
<i>Carissa bispinosa</i> .....	334	var. <i>cordata</i> .....	9
<i>Ehretia rigida</i> .....	240	<i>Vepris undulata</i> ...	7
<i>Brachylaena ilicifolia</i> .....	210	<i>Euclea schimperi</i>	
<i>Acacia karroo</i> .....	170	var. <i>daphnoides</i> .....	4
<i>Asparagus asparagooides</i> .....	152	<i>Canthium obovatum</i> .....	2

Trees and shrubs of less general occurrence include:—

<i>Cassine tetragona</i> ..	822	<i>Maytenus undata</i> ...	362
<i>Putterlickia pyracantha</i> .....	487	<i>Rhoicissus tridentata</i> .....	212
<i>Asparagus racemosus</i> .....	463	<i>Rhoicissus digitata</i>	211
<i>Rhoiacarpos capensis</i> .....	357	<i>Rhus longispina</i> ....	191
<i>Aloe ciliaris</i> .....	313	<i>Pleurostylia capensis</i> .....	163
<i>Suregada africana</i> ..	244	<i>Euphorbia tetragona</i> ....	127
<i>Jatropha capensis</i> ..	237	<i>Grewia robusta</i> ....	122

and many more.

Note that the commonest species are thorny scramblers. *Euphorbia grandidens* is also of very local importance; while the three tree-Euphorbias (*E. triangularis*, *E. tetragona* and *E. grandidens*), although they may all occur in one sample, generally do not mix.

Smaller plants of general occurrence are:—

<i>Sansevieria thyrsiflora</i> .....	8 726	<i>Moraea iridioides</i>	454
<i>Panicum deustum</i> .....	5 848	<i>Croton rivularis</i> ....	405
<i>Viscum rotundifolium</i> ....	1 051	<i>Asparagus stipulaceus</i> .....	361

Of less general occurrence in the undergrowth are:—

<i>Hypoestes verticillaris</i> .....	33 023	<i>Cyperus albostriatus</i> .....	662
<i>Panicum maximum</i> 5 946		<i>Pellaea viridis</i> .....	551
<i>Ehrharta erecta</i> ....	5 161	<i>Themeda triandra</i> ..	501
Other Acanthaceae	3 193	<i>Eragrostis chloromelas</i> ....	495
<i>Cyanotis speciosa</i> ..	1 872	<i>Crassula multicava</i> ..	490
<i>Crassula cordata</i> ...	1 866	<i>Barleria obtusa</i> ....	450
<i>Plectranthus madagascariensis</i>	1 716	<i>Setaria chevalieri</i> ...	350
<i>Aptenia cordifolia</i>	1 368	<i>Crassula perforata</i> ..	324
<i>Sporobolus imbricatus</i> .....	1 082	<i>Asparagus striatus</i> ..	319
<i>Cynodon dactylon</i> .....	845	<i>Sida triloba</i> .....	318
<i>Setaria neglecta</i> .....	772	<i>Delosperma ecklonis</i> .....	313
<i>Heteropogon contortus</i> .....	743		

and many more, the total number of species in the Relative Abundance Table Being 505.

In this denser bush there is less undergrowth and it includes few of the veld grasses and none in an important rôle, though the shade grasses are still plentiful.

In both these variations, the bush tends to be scrubby and reaches a higher altitude on the hotter and drier northern and western aspects, than it does on southern and eastern aspects. On the latter it is regularly tall *Euphorbia* forest, often with *Aloe bainesii*, merging, on the upper slopes, directly into forest, or, where the forest has been destroyed, into grassveld or thornveld. On the upper northern and western aspects there is generally a zone of *Acacia caffra*-thornveld in the northern parts or of bush-clump-*Acacia karoo*-thornveld in the southern parts, in both cases with mixed grass. Indeed, if we visualize the country east of the Drakensberg as having been covered with forest and scrub forest, these strips of mixed thornveld along the southern edges of the valleys are almost a necessary postulate to explain the origin of the sour grassveld which has replaced the forest. The bushclumps are, as in the Transvaal bushveld, usually associated with termitaria; and in cases where the bush has been destroyed, we find hummocks in the grassveld strongly resembling the "heuweltjies" of the west coast belt. The flora of the bushclumps includes the less xerophytic species of the Valley Bushveld together with species of the forest margin.

#### (c) Fish River Scrub

(See Reynolds, Pl. 54, Fig. 462; White, Dyer and Sloane, Figs. 972, 989; Dyer, Figs. 18, 20, 23, 24, 25, 26, 27, 33)

This veld type occupies the wide, flat valley of the Great Fish River, at elevations ranging from about 100-450 m above sea-level; very hot country and receiving a rainfall of only 350-500 mm per annum, mainly in the summer months (Fig. 47). It is an adaptation of the Valley Bushveld to these exacting conditions. In its undamaged state it is an extremely dense, semi-succulent, thorny scrub, about 2m high; but it has been opened up, overgrazed over large areas, and invaded by the prickly

FIG. 47.—Fish River Scrub (23c) north of Grahamstown. *Aloe ferox* and *Scutia myrtina* in foreground.



pear and in some parts so heavily by *Euphorbia bothae* that to-day it closely resembles Noorsveld. A similar result of excessive grazing pressure is found in the Tugela Valley, where dense patches of *Euphorbia pesudocactus* are developing, though still on a small scale. Along the escarpment on the north side of the valley, in the narrower lower part of the valley and in the tributary valleys of the Kat and other rivers, there is a fringe of Valley Bushveld; but on the hotter south side there is little development of Valley Bushveld, except in some of the kloofs, the Fish River Scrub becoming less thorny and succulent as one climbs, thinning out into bushelumps and finally merging into the scrub-forest of the Grahamstown plateau. At least, that is the climax condition, though its pattern has been obscured by destruction of the scrub-forest and by invasions of Karoo, renosterbos and Fynbos. On the floor of the valley, the scrub is being invaded, and in parts replaced by Karoo of Lower Central type, while on the upper slopes, patches of *Pteronia incana* are developing.

In the Fish River Scrub, the following are the trees and shrubs of general occurrence:

<i>Portulacaria afra</i> ....	8 609	<i>Capparis sepiaria</i>	
<i>Grewia robusta</i> ....	5 136	var. <i>citrifolia</i> ....	870
<i>Euphorbia bothae</i> ..	4 727	<i>Rhus refracta</i> ....	870
<i>Rhoicissus digitata</i>	4 227	<i>Euclea undulata</i> ...	629
<i>Asparagus striatus</i> .	3 823	<i>Schotia afra</i> var.	
<i>Ptaeroxylon obliquum</i> .....	3 468	afra.....	379
<i>Maytenus capitata</i>	3 378	<i>Pelargonium peltatum</i> .....	94
<i>Azima tetrancantha</i>	3 357	<i>Lycium spp</i> .....	89
<i>Jatropha capensis</i> ..	3 337	<i>Rhus undulata</i> var.	
<i>Phyllanthus verrucosus</i> .....	2 271	undulata.....	88
<i>Asparagus racemosus</i> ....	1 700	<i>Carissa haematocarpa</i> ...	67
<i>Pappea capensis</i> ...	1 691	<i>Ozoroa mucronata</i> ..	53
<i>Senecio vitalis</i> ....	1 675	<i>Euphorbia pentagona</i> .....	40
<i>Brachylaena ilicifolia</i> .....	1 561	<i>Maytenus undata</i> ..	37
<i>Crassula portulacea</i>	1 271	<i>Grewia occidentalis</i>	36
<i>Aloe ferox</i> .....	1 230	<i>Capparis oleoides</i> ..	18
<i>Ehretia rigida</i> .....	1 160	<i>Acacia karroo</i> ....	14
<i>Rhigozum obovatum</i> .....	1 141	<i>Euphorbia tetragona</i> .....	9
<i>Sarcostemma viminale</i> .....	920	<i>Helichrysum sp. =</i>	
<i>Asparagus subulatus</i> .....	870	A. 13 735.....	9
		<i>Cussonia spicata</i> ...	6
		<i>Diospyros scabrida</i>	
		var. <i>cordata</i> .....	3

Trees and shrubs of less general occurrence include:—

<i>Asparagus racemosus</i> .....	558	<i>Plumbago auriculata</i> .....	24
<i>Secamone frutescens</i> .....	278	<i>Putterlickia pyracantha</i> .....	24
<i>Cadaba aphylla</i> ....	24	<i>Schotia latifolia</i> ...	24

their fewness (among the commoner species) suggesting that this must be a very uniform veld type.

Species of general occurrence in the undergrowth are:—

<i>Crassula lycopodioides</i> ....	6 944	<i>Limeum aethiopicum</i>	
<i>Sansevieria thyrsiflora</i> .....	5 012	subsp. <i>aethiopicum</i> ....	89
<i>Crassula perforata</i>	4 227	<i>Kalanchoe rotundifolia</i> ....	53
<i>C. cultrata</i> .....	3 337	<i>Viscum rotundifolium</i> ....	39
<i>Cotyledon ramosissima</i> ....	1 670	<i>Lasiocorys capensis</i>	37
<i>Panicum deustum</i> ....	1 322	<i>Euphorbia mauritanica</i> ....	6
<i>Mestoklema tuberosum</i> ....	1 227	<i>E. rectirama</i> .....	6
<i>Chrysocoma tenuifolia</i> .....	1 112	<i>Hermannia gracilis</i>	6
<i>Crassula tetragona</i>	870	<i>Senecio radicans</i> ...	6
<i>Asparagus stipulaceus</i> .....	227		

with the following, and many more, of less general occurrence, the total number of species in the Relative Abundance Table being 215:—

<i>Acanthaceae</i>		<i>Sporobolus nitens</i> ..	898
(various).....	3 756	<i>Panicum maximum</i>	625
<i>Adromischus poellnitziianus</i> ....	1 111	<i>Pentzia incana</i> ....	625
<i>Crassula cordata</i> ....	1 111	<i>Setaria neglecta</i> ...	578
<i>C. mesembryanthemoides</i> .....	1 111	<i>Crassula lactea</i> ....	561
<i>Digitaria argyrograpta</i> ....	1 111	<i>Aloe striata</i> .....	557
<i>Kedrostis</i> sp.....	900	<i>Sporobolus fimbriatus</i> .....	280
		<i>Crassula rupestris</i> ..	278

Succulents and thorny plants, thus, are of great importance in this veld type. It is of interest to note that *Themeda triandra* occurs in this veld, even where on silty and stony slopes down in the valley, the scrub has been broken right down to *Pentzia incana*, *Lasiosiphon meisnerianus*, *Aloe tenuior*, *Becium burchellianum*, *Chrysocoma tenuifolia*, *Pteronia incana*, *Euphorbia mauritanica*,

*Drosanthemum lique*, *Malephora uitenhagensis*, *Ruschia parvifolia*, *Eriocephalus africanus*, etc., i.e. False Karoo. It is accompanied by *Cymbopogon plurinodis*, *Digitaria argyrograpta*, *Setaria neglecta*, *Sporobolus nitens*, *Tragus koelerioides*, *Eragrostis obtusa*, *Panicum staphianum*, *Sporobolus fimbriatus* and *Eragrostis chloromelas*, suggesting that some form of sweet grassveld of similar type to the Eastern Province Grassveld, or grassy shrub-savanna, could, with appropriate management, be established in place of the scrub. At higher levels on the south side of the Fish River valley, where the rainfall is a bit better and the climate not so hot, there is no doubt at all that grassveld and grassy savanna naturally follow the scrub in the reversed succession; traces of it can be seen on the Grahamstown-Bedford road, in spite of a strong Karoo invasion. It has the peculiarity of being invaded by *Merxmuellera disticha* before the Karoo invades, suggesting an affinity with the Karroid *Merxmuellera* Mountain Veld.

The reversed succession down in the valley would appear, therefore, to be:—

(1) Dense, useful succulent scrub with some grass (climax).

(2) Open, useful, succulent scrub with much grass (optimum stage and probably better than artificial pure grassveld).

(3) Open succulent scrub with thorny shrubs and useless succulents invading and/or increasing, and Karoo bushes and mesembs invading the grassveld constituent (critical stage).

(4) Useless succulent, thorny scrub with weedy Karoo bush and mesembs and little grass in an eroded, sun-baked, wind-swept wilderness.

#### (d) (i) Addo Bush

(See Marloth III, 1, Fig. 8)

This and the following variation appear to be derived directly from the Alexandria Forest, rather than from the Valley Bushveld. The Fish River valley where the Fish River Scrub occurs, is an inland valley, cut off from the influence of the sea by the Peddie Plateau and the Grahamstown heights, whereas the Sundays River valley lies open to the influence of the sea.

Little information has been collected about the fully developed Addo Bush, except that it is a short, dense, dry forest, dominated by such species as *Schotia afra* var. *afra*, *S. latifolia*, *Sideroxylon inerme*, *Olea africana*, *Cussonia spicata*, *Cassine aethiopica* and *C. peragua*, with abundance of shrubs and climbers, e.g. *Azima tetracantha*, *Portulacaria afra*, *Rhoiacarpos capensis*, *Plumbago auriculata*, *Rhus longispina*, *Scutia myrtina*, *Rhoicissus digitata*, *Sarcostemma viminale* and *Capparis sepiaria* var. *citrifolia*.

#### (ii) Sundays River Scrub

(See Marloth II, 2, Fig. 94; IV, Fig. 23; Reynolds, Pl. 17; White, Dyer and Sloane, Figs. 961, 965)

More information is available about the Sundays River Scrub (Fig. 48), into which the Addo Bush easily merges. In general appearance it is much like the Fish River Scrub, but is less succulent and rather taller. *Euphorbia bothae* of the Fish River Scrub is replaced by *E. ledienii*, and prickly pear is still conspicuous in parts, biological control having been less effective here than further inland. In what little development of Valley Bushveld there is on the sides of the valley, *Euphorbia grandiflora* largely replaces *E. tetragona*, *E. triangularis* and *E. curvirama*. Tall *Aloe* spp. are conspicuous in this veld (*Aloe ferox*, *A. speciosa*, *A. africana*, *A. pluridens*, *A. lineata*). Elevation ranges from 0 to over 450 m above sea-level and rainfall from 250-500 mm per annum, spread over the year.

Trees, shrubs and climbers of general occurrence are:—

<i>Rhoicissus digitata</i>	7 669	<i>Aloe ferox</i> .....	855
<i>Capparis sepiaria</i>		<i>Senecio longifolius</i>	733
var. <i>citrifolia</i> .....	4 484	<i>Sideroxylon inerme</i>	645
<i>Euclea undulata</i> ....	4 418	<i>Pappea capensis</i> ....	621
<i>Rhus longispina</i> ...	4 250	<i>Lycium</i> spp.....	455
<i>Schotia afra</i> var.		<i>Crassula portulacea</i>	185
<i>africana</i> .....	4 230	<i>Asparagus</i>	
<i>Azima tetracantha</i>	3 311	<i>subulatus</i> .....	139
<i>Asparagus</i>		<i>Viscum</i>	
<i>racemosus</i> .....	2 894	<i>rotundifolium</i> ....	134
<i>Pelargonium</i>		<i>Ehretia rigida</i> .....	72
<i>peltatum</i> .....	2 666	<i>Aloe speciosa</i> .....	68
<i>Carissa bispinosa</i> ...	2 597	<i>Cassine aethiopica</i>	29
<i>Sarcostemma</i>		<i>Asparagus</i>	
<i>viminale</i> .....	2 325	<i>africanus</i> .....	28
<i>Euphorbia ledienii</i>	2 188	<i>Rhus refracta</i> .....	23
<i>Putterlickia</i>		<i>Maytenus</i>	
<i>pyracantha</i> .....	1 738	<i>heterophylla</i> ....	21



FIG. 48.—Sundays River Scrub (23di) at Kirkwood. Thicket of *Maytenus polyantha*, *Portulacaria afra* and *Aloe speciosa*.

Maytenus capitata	1 302	Maerua parvifolia..	14
Portulacaria afra..	1 207	Ptaeroxylon obliquum.....	11
Grewia robusta....	1 015	Opuntia ficus-indica	9
Scutia myrtina....	1 015	Capparis oleoides..	2
Maytenus polycantha.....	910	Cussonia spicata...	2
Rhoicissus digitata	861	Acacia karroo.....	0,3
Plumbago auriculata.....	856		

Trees, shrubs and climbers of less general occurrence include:—

Cassine tetragona ..	557	Asparagus asparagooides.....	218
Asparagus racemosus.....	425	Cadaba aphylla.....	225
Lycium campanulatum...	361	Senecio pyramidalis.....	139
Cynanchum ellipticum.....	350	Brachylaena ilicifolia.....	92
Euphorbia pentagona.....	301	Asparagus falcatus.	69
Grewia occidentalis	283	A. setaceus.....	69
		Phyllanthus verrucosus.....	69

and many more.

In the undergrowth, the following are of general occurrence:—

Sansevieria thyrsiflora.....	14 340	Hermannia incana..	122
Crassula perforata..	6 752	Euphorbia rectirama.....	109
Panicum deustum..	4 574	E. mauritanica.....	86
Senecio radicans...	4 437	Crassula lycoptoides....	85
Crassula cultrata...	2 755	Kedrostis sp.....	81
Asparagus stipulaceus.....	1 284	Asparagus asparagooides.....	75
Fockea sp.....	981	Cotyledon orbiculata.....	71
Crassula acutifolia	877	Helichrysum sp. cf.	64
Eragrostis obtusa..	689	H. rosum.....	64
Selago triquetra...	566	Crassula spathulata	21
Setaria nigrirostris.	510		
Crassula mesembryanthemoides..	420		

with the following of less general occurrence:—

Plectranthus madagascariensis	20 012	Trochomeria sp....	939
Hypoestes verticillaris.....	6 400	Crassula sp.....	800
Mesemb spp.....	6 347	Justicia capensis....	793
Tritonia securigera.	3 490	Digitaria argyrograpta....	639
Delosperma ecklonis.....	1 736	Stipa dregeana var.	550
Gasteria spp.....	1 417	elongata.....	400
Oxalis semiloba....	1 209	Other Acanthaceae	400
Cynodon incompletus.....	1 111	Dipliditera capensis	365
Hypoxis sp. = A. 13640.....	1 031	Asparagus striatus.	329
		Panicum maximum	329
		Felicia muricata...	311
		Crassula expansa..	306
		Zygophyllum debile	211

and many more, the total number of species in the Relative Abundance Table being 307.

Here succulents total 36 162 as compared with 36 921 in the Fish River Scrub.

Here thorny plants total 23 757 as compared with 19 753 in the Fish River Scrub.

Here climbers total 27 476 as compared with 12 937 in the Fish River Scrub.

So the Sundays River Scrub is just as succulent as the Fish River Scrub (except that the succulents are mostly smaller), and even more thorny and tangled. Near the mouth of the Sundays and Swartkops rivers, the scrub is very stunted, including such species as *Lycium afrum*, *Zygophyllum morgsana*, *Senecio longifolius*, *Suaeda fruticosa*, *Lasiocorys capensis*, *Drosanthemum fourcadei* and clumps of normal bush and tends to be replaced by Succulent Karoo on heavy soil, by stunted Fynbos on sand and limestone, rather than by the *Pentzia*-dominated False Central Lower Karoo which invades in the more inland parts.

#### (e) The Gouritz River Scrub

(See King, Fig. 296)

This variation occurs in the valleys of the Gouritz, Little Brak and Great Brak rivers, with traces only occurring in the valleys westwards (Fig. 49). It is closely related to the Sundays River scrub, except that the big scrubby and arborescent *Euphorbia* spp. are replaced entirely by tall *Aloe* spp. (*A. ferox*, *A. speciosa*, *A. arborescens*), the only *Euphorbias* seen being the smaller *E. burmannii*, *E. mauritanica*, and *E. clava*; and *Portulacaria afra* is absent. Like most of the Sundays River Scrub, it merges upwards into Fynbos and Rhenosterbosveld, and there is a well marked aspect difference, the scrub of the southern aspects being non-succulent and non-thorny, but very dense, comparable with that of southern aspects in the Spekboomveld and the Karroid Broken Veld, but with a larger element of Fynbos in it. This veld type may become replaced by groves of *Aloe ferox*, e.g. below Herbertsdale and around Riversdale.



FIG. 49.—Gouritz River Scrub (23e). Note tall *Aloe* spp.

## 24 NOORSVELD

[See Marloth II, 2, Fig. 91; Reynolds, Pl. 66, Fig. 511; White, Dyer and Sloane, Fig. 713 (Pappea-veld). Figs. 949, 950, 952, 953, 955, 957, 960]

This veld type rather resembles those tramped out parts of the Fish River Scrub where *Euphorbia bothae* has become dominant. It is a uniform, 1-2 m high scrub of grey, shrubby *Euphorbia coeruleascens* (Noors), dotted with small trees (Fig. 50). It occupies the wide, undulating middle part of the Sundays River valley, north of the Grootriver Heights and Suurberg, and centred on Jansenville. Up the northern slopes of these mountains and up the slopes of hills to the north, it merges into Spekboomveld, while on the plains to the west and east, and north of the hills, it peters out, via open *Pappea* Veld, into open Karroid Broken Veld. Outliers occur on the lower northern slopes of the Great Winterhoek mountains. Elevation ranges 300-600 m above sea-level and rainfall is about 250 mm per annum, mostly a little less.

*Euphorbia coeruleascens* is overwhelmingly dominant, along with:—

Rhigozum obovatum	Nymania capensis
Grewia robusta	Schotia afra var. afra
Maytenus polyantha	Lycium austrinum
Euclea undulata	Carissa haematoxarpa
Capparis oleoides	Rhus undulata var. undulata
Pappea capensis	Aloe ferox
Maytenus capitata	Portulacaria afra

but, apart from the taller, dark green *Pappea*, *Schotia*, *Capparis* and *Lycium*, these shrubs are inconspicuous.

Owing to the ability of goats to eat chopped *Euphorbia coeruleascens*, as a last resort in drought, this veld type has suffered particularly badly from overgrazing, and in its present condition is often seen dimly through a sand storm. The eroded stony spaces between the shrubs, therefore, are usually bare, apart from a little *Pentzia incana* (ankerkarroo), *Eriocephalus ericoides*, *Euphorbia ferox*, *Selago triquetra*, *Indigo sessilifolia*, *Mestoklema tuberosum*, *Eragrostis obtusa*, *Phymaspernum pubescens* and others, and sometimes annuals, notably *Psilocaulon absimile*. Nevertheless, in the shelter of the shrubs one can still find such grasses as *Setaria neglecta*, *Aristida diffusa* var. *burkei*, *Digitaria*

*argyrograpta*, *Themeda triandra*, *Heteropogon contortus*, *Eragrostis lehmanniana*, *E. curvula*, *Cenchrus ciliaris*, *Panicum maximum*, *Sporobolus fimbriatus*, *Enneapogon scoparius* and *Ehrhartia calycina*, suggesting that even in this dry region, the Karoo is an invader. Certainly it supports the view that these karroid bushveld types are related to the Karoo only to the extent that certain of the shrubs belonging to them occur in the Great Karoo and Little Karoo, i.e. these Karoo types can rather be said to have a bushveld affinity than the succulent bushveld types can be said to have a Karoo affinity. It would thus be better to use the term Succulent Bushveld in place of Karroid Bushveld.

## 25 SUCCULENT MOUNTAIN SCRUB OR SPEKBOOMVELD

This is essentially a veld type of steep, sandstone, quartzite and shale mountain slopes in the east and southern Cape, which receive 250-300 mm of rain per annum. It is typically a dense scrub (Fig. 51) dominated by *Portulacaria afra* (spekboom), with more or less of the shrubs of the other succulent bushveld types, but lacking the tangled thorniness of those types; the admixture of other species become less and less westwards, until towards its western limits, it is almost a pure stand of *Portulacaria*, e.g. on the red precipices of Huis River Pass. On steep southern aspects, *Portulacaria* is often rare or even absent and the vegetation is a more or less non-succulent scrub or even scrub-forest; on a small scale map it cannot be shown separately.

Along the Baviaanskloof, the presence of *Euphorbia grandiflora* both in the Spekboomveld and the non-succulent scrub of the southern aspect, suggests a derivation from the Valley Bushveld; and it merges easily into the Valley Bushveld in the eastern part of its habitat, e.g. in the Great Fish River valley between Cookhouse and Cradock, where, however, most of both these types has been reduced to False Karroid Broken Veld.

Besides *Portulacaria afra*, important trees and shrubs include:—

Crassula portulacea	Rhus longispina
Lycium austrinum	Schotia afra var. afra
Pappea capensis	S. latifolia
Euclea undulata	Rhus lucida
Rhigozum obovatum	Tarchonanthus minor
Grewia robusta	



FIG. 50.—Noorsveld (24) near Lake Mentz in the Sundays River Valley in the Cape. Species noted: *Euphorbia caeruleascens*, *Boscia oleoides*, *Schotia afra* var. *afra*, *Lycium austrinum*, *Euclea undulata*, *Psilocaulon absimile*, *Themeda triandra*, *Digitaria eriantha* and *Panicum maximum*.

FIG. 51.—Succulent Mountain Scrub or Spekboomveld (25) on the hills to the north of Steytlerville, Cape. Species noted: *Portulacaria afra*, *Crassula portulacea*, *Boscia oleoides*, *Pappea capensis*, *Rhigozum obovatum*, *Euclea undulata*, *Euphorbia caerulescens*, *Themeda triandra* and *Digitaria eriantha*.



*Putterlickia pyracantha*  
*Maytenus undata*  
*Rhoicissus digitata*  
*Nymmania capensis*  
*Aloe speciosa*

while among the smaller plants are:—

<i>Crassula perforata</i>	<i>Dodonaea viscosa</i> var. <i>angustifolia</i>
<i>C. rupestris</i>	<i>Buddleia glomerata</i>
<i>C. cultrata</i>	<i>Polygala myrtifolia</i>
<i>C. tetragona</i>	<i>Carissa haematocarpa</i>
<i>C. lycopodioides</i>	
<i>C. rogersii</i>	<i>Delosperma frutescens</i>
<i>C. obvallata</i>	<i>Cotyledon ramosissima</i>
<i>C. perfoliata</i>	<i>C. orbiculata</i>
<i>Euphorbia mauritanica</i>	<i>Ruschia</i> spp.

In the southern part of its habitat it regularly gives way rather suddenly upwards to an open, grassy, false macchia, with such species as:—

<i>Passerina obtusifolia</i>	<i>Diospyros lycioides</i> subsp. <i>lycioides</i>
<i>Polygala myrtifolia</i>	<i>Laisophrion meisnerianus</i>
<i>Selago albida</i>	<i>Aloe ferox</i>
<i>Elytropappus rhinocerotis</i>	<i>A. comptonii</i>
<i>Felicia filifolius</i>	<i>Montinia caryophyllacea</i>
<i>Erioccephalus africanus</i>	<i>Anthospermum tricostatum</i>
<i>E. capitellatus</i>	<i>Agathosma ovata</i>
<i>Chrysocoma tenuifolia</i>	<i>Aspalathus</i> spp.
<i>Pteronia incana</i>	<i>Ruschia</i> spp.
<i>Rhus incisa</i>	<i>Encephalartos lehmannii</i>
<i>Indigofera stenophylla</i>	<i>Euphorbia rectirama</i>
<i>Diospyros scabrida</i> var. <i>cordata</i>	<i>Machaerophyllum</i> <i>acuminatum</i>

with the following grasses:—

<i>Themeda triandra</i>	<i>Melica racemosa</i>
<i>Sporobolus fimbriatus</i>	<i>Eragrostis curvula</i>
<i>Setaria lindebergiana</i>	<i>E. chloromelas</i>
<i>Ehrharta calycina</i>	<i>Aristida diffusa</i> var. <i>burkei</i>
<i>Merxmuellera disticha</i>	<i>Heteropogon contortus</i>
<i>M. stricta</i>	<i>Rhynchelytrum repens</i>
<i>Pentaschistis</i> spp.	

In the north-eastern part of its habitat, where it fringes Bruintjieshoogte, the Tandjiesberge and the mountains around Graaff-Reinet, it merges upwards into the Grassy Mountain Scrub variation of the Karroid Broken Veld (in which *Rhus lucida* is dominant) and so into the Karroid *Merxmuellera* Mountain Veld or into False Karoo. In the Jansenville area, and in some of the valleys of the Grootrivier Heights, it merges downwards gradually into Noorsveld; elsewhere it breaks off rather suddenly at the edge of the Karroid Broken Veld and Succulent Karoo.

The scrub of steep south aspects is rather related to the False Fynbos above the Spekboomveld, but taller and denser, ranging from semi-succulent Rheinoesterbosveld plus *Dodonaea viscosa* var. *angustifolia*, *Rhus lucida* and *Euclea undulata*, up to complete scrub-forest like the upper margin of the Valley Bushveld. Succulents are not entirely absent, but, although arborescent *Aloe* spp. may be conspicuous, they are never dominant.

This veld type has suffered much damage from overgrazing (Fig. 52) and from invasion by prickly pear; and it is probable that it has been entirely destroyed over long stretches of mountainside. The differential effects of grazing treatment are very clearly seen on the Wolverineberg.

## 26 KARROID BROKEN VELD

This is the veld of the Great Karoo, the Little Karoo and the Robertson Karoo. It is Karoo veld dotted with dwarf trees and shrubs, and including varying amounts of grass and succulents. Three main variations can be distinguished:—

(a) *The Great Karoo*, in which succulents are usually relatively scarce, but grass species are surprisingly numerous, though usually rare as regards number of individual plants. Shrubs are scarce too. This variation occupies undulating stony plains, receiving a rainfall ranging from under 150 mm to about 200 mm per annum, mostly in autumn; elevation above the sea ranges from 450-1 050 m.

(b) *The Little Karoo* (including the Robertson Karoo), in which succulents are dominant and the dwarf trees and shrubs are numerous; grasses, on the other hand, are scarce. This occupies rocky, hilly country, at elevations ranging from 300-600 m above the sea, and receiving 150-300 mm of rain per annum, distributed, on the average through the year; the climate is hot. The permanent scarcity of rain will partly explain the prevalence of succulents, while the low altitude and the better soil-water relations produced by the rocky hilliness will explain the shrubiness. Thus it can be noticed that the flatter parts of the Little Karoo, e.g. in Oudtshoorn Division, have less shrubiness, and the few rocky parts of the Great Karoo, e.g. south of Beaufort West, have more shrubiness than average. A fringe of this variation separates the southern margin

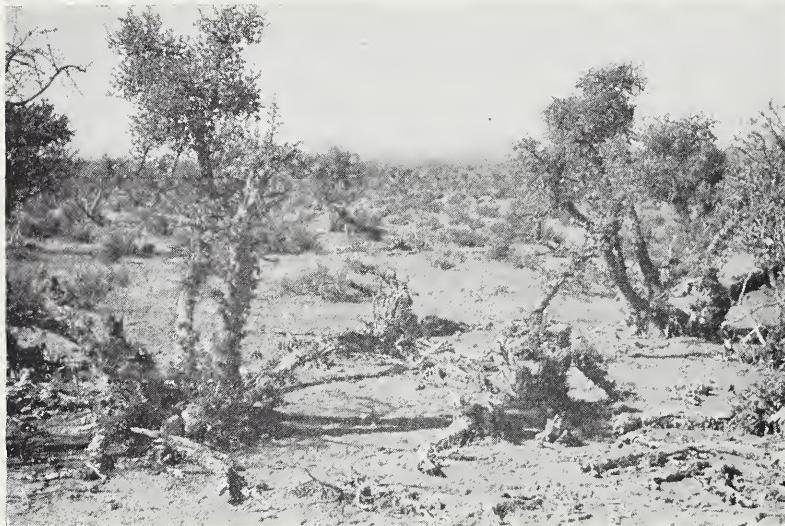


FIG. 52.—Destruction of Spekboomveld (25) by goats near Mt Stewart in the Cape converting it to False Karroid Broken Veld (37). Species noted: *Portulacaria afra*, *Rhus undulata* var. *undulata*, *Lycium austrinum*, *Grewia robusta* and *Pentzia incana*.

of the Great Karoo from the Spekboomveld and False Fynbos of the Swartberg and other mountains as far east as Willowmore.

(c) *The Grassy Mountain Scrub*, through which the Karroid Broken Veld passes into the grassveld and Fynbos of the mountains.

#### (a) The Great Karoo

(See Cannon, Pl. 6A and B, 7A, 8; Hutchinson, p. 60, facing p. 192; King, Figs. 91, 169)

These stony plains are so completely denuded of soil that it is difficult to imagine them in any other condition. Here and there, however, one finds indications, e.g. patches of silt high on either side of a stony valley, that it was not always so, so that the country in which the Bushmen lived and which the first Trekkers saw, was not the wilderness that it is to-day, arid though it may have been. The idea that the Great Karoo is naturally what it is today receives a bad jolt when one finds a grass like *Heteropogon* in the heart of the Koup, where the rainfall today is only 150 mm per annum; or *Themeda* at the foot of the Nieuwveld escarpment, where the rainfall is only 200 mm; and sees what a transformation a few years or rest, e.g. along the National Road between Prince Albert Road and Beaufort West, or a few years of careful management, e.g. on Mr Mocke's farm Vindragersfontein near Merweville, can bring about. If the rocky parts can still support such grasses, what was the vegetation of the riverine vleis when they were real vleis, vegetated and capable of controlling and using the water which came down from the mountains, instead of being the stony, over-efficient drains that they are today?

The vegetation today is sparse Karoo veld (Fig. 53) with stunted shrubs, especially in rocky (as distinct from stony) places, and thornveld along the rivers. In the drier western part where the Great Karoo veld merges into that of the Little Karoo, *Tamarix usneoides* also becomes important along the rivers.

The principal karoo bushes are:—

- Pentzia spinescens*
- Erioccephalus spinescens*
- Galenia fruticosa* var. *prostrata*
- Zygophyllum microphyllum*
- Pteronia glomerata*
- P. adenocarpa*

- Trianthema triquetra* subsp. *parvifolia*
- Monechma pseudopatulum*
- Delosperma subincanum*
- Asparagus* sp.
- Lebeckia spinescens* w
- Salsola rabeiana*

- Drosanthemum framesii*
- D. lique*
- Hermannia cuneifolia*
- Erioccephalus pubescens*
- E. ericoides*
- Garuleum bipinnatum*
- Osteospermum sinuatum*
- Pentzia incana* (*Ankerkaro*)
- P. globosa*
- Felicia filifolia*
- Sericocoma avolans*
- Hermannia spinosa*
- Sarcocaulon patersonii*
- Limeum aethiopicum* subsp. *aethiopicum*
- Trichodiadema barbatum* t
- Barleria rigida*
- Helichrysum lucilioides*
- Lasiosiphon meisnerianus*
- Dicoma spinosa*
- Microloma massonii*
- Euphorbia arida*
- Chrysocoma tenuifolia*
- Hermannia grandiflora*
- Polygala seminuda*
- Euphorbia stellaeispina* and many other spp., especially eastwards
- Hermannia linifolia*
- Tetragonia fruticosa*

The principal shrubs and trees are:—

- Acacia karroo* W
- Rhus lancea* W
- Tamarix usneoides* WW
- Diospyros pallens* W
- Nicotiana glauca* W
- Salsola aphylla* W
- S. sp. prob. *S. geminiflora* W
- Suaeda fruticosa* W
- Zygophyllum* microcarpum W
- Rhigozum obovatum*
- Carissa haematoxarpa*
- Rhus undulata* var. *tricrenata*
- Maytenus polyantha*
- M. heterophylla*
- Lycium arenicolum*
- L. austrinum*
- Thesium lineatum*
- Asclepias buchenaviana*
- Euclea undulata* W

The principal perennial grasses are:—

- Stipagrostis obtusa*
- Enneapogon scaber*
- E. desvauxii*
- Oropetium capense*
- Eragrostis obtusa*
- E. rotifer* W, h
- E. bicolor* h
- Aristida diffusa* var. *burkei*
- Stipagrostis ciliata*
- Digitaria argyrograppa*
- Fingerhuthia africana*
- Cenchrus ciliaris* tw
- Tragus koelerioides*
- Stipagrostis namaquensis* W
- Heteropogon contortus*
- Themeda triandra*
- Eragrostis lehmanniana*
- Digitaria eriantha*
- Sporobolus fimbriatus*
- Stipagrostis anomala*
- Stipagrostis uniplumis*

The annuals (including grasses) and geophytes include:—

- Aristida adscensionis*
- A. congesta* subsp. *congesta*
- Augea capensis*
- Mesembryanthemum* spp.
- Euphorbia inaequilatera*
- Moraea polystachya*
- Gazania lichensteinii*
- Galenia sarcophylla*
- Tribulus terrestris*
- Tragus racemosus*
- Schizobasis intricata*
- Hypertelis salsolooides*
- Eragrostis porosa*
- Amaranthus schinzianus*
- Psilocaulon absimile*
- Brownanthus ciliatus*
- Radyera urens*
- Ornithoglossum viride*
- Enneapogon cenchroides*
- Ursinia nana*
- Eragrostis procumbens*
- Sphalanthus tetragonus*
- Mollugo cerviana*
- Sutera tristis*
- Eragrostis* sp. = A. 14 327

and many more; a rich flora in spite of the sparseness of the vegetation today. The phenomenon of "dry rain" in these parts has already been discussed.

FIG. 53.—The Great Karoo (26a) in the vicinity of Prince Albert Road, Cape. The dwarf shrub is *Cylindrophyllum calamiforme*.



In the gap in the escarpment between the Nieuwveld Mountains and the Camdeboo mountains, the Great Karoo extends up the valleys and, in scrubby form, up the slopes of the isolated mountains. Here the Great Karoo (and the Central Lower Karoo) merge directly into the Central Upper Karoo.

#### (b) The Little Karoo

[See Marloth I, Fig. 84A; II, 1, Pl. 6; III, 1, Pl. 11; III, 2, Fig. 80, Pl. 68; IV, Fig. 45; Cannon, Pl. 12, 15, 16, 17, 18B, 21; Reynolds, Pl. 45 (outlier); Hutchinson, facing pp. 64, 65; White, Dyer and Sloane, Figs. 399, 709; King, Figs. 85, 292, 295; Adamson, Photo 17]

This is distinguished from the Great Karoo only by the greater number of shrubs and succulents occurring in it, and there is no clear cut boundary between the two in the western part of their area, the Little Karoo veld around Laingsburg merging gradually into the Great Karoo veld (Figs. 54 and 55). Similarly, both variations of the Karroid Broken Veld merge easily into the Succulent Karoo, when the succulents increase to the point of dominance and the shrubs thin out to nil.

Justice cannot at this stage be done to the Little Karoo flora, because only those species of *Mesembryanthemum* (in the wide sense) can be mentioned, which the writer succeeded not only in finding in flower, but in delivering to the late Dr L. Bolus before the flowers faded. Many of the mesembs are even more difficult to distinguish in the vegetative condition than they are when flowering, particularly those bushy ones that are important constituents of the vegetation, so that the listing method cannot yet be adequately applied to such veld types as the Little Karoo and the Succulent Karoo. Although the mesembs are so important today, the fact that few of them are eaten by livestock and the fact that non-succulent karoo-bushes are still quite common, but always eaten down into woody stumps, suggests that the *dominance* of the mesembs is an artificial phenomenon, resulting from selective overgrazing and soil erosion.

The typical shrub (or dwarf tree) is *Euclea undulata*; its principal associates are:—

<i>Cotyledon paniculata</i>	<i>Pappea capensis</i>
<i>Carissa haematoxarpa</i>	<i>Schotia afra</i> var. <i>afra</i>
<i>Lycium austrinum</i>	<i>Asparagus racemosus</i>
<i>L. arenicolum</i>	<i>Zygophyllum foetidum</i>
<i>Rhigozum obovatum</i>	<i>Pelargonium peltatum</i>
<i>Rhus undulata</i> var. <i>undulata</i>	<i>Euphorbia mauritanica</i>
<i>Putterlickia pyracantha</i>	<i>E. burmannii</i>
<i>Cadaba aphylla</i>	<i>Thesium lineatum</i>
<i>Microdon cylindricus</i>	<i>Nymania capensis</i>

The karoo bushes include:—

<i>Eriocephalus ericooides</i>	<i>Euphorbia mundii</i>
<i>Pentzia incana</i> (ankerkaro)	<i>E. rectirama</i>
<i>Hippeastrum integrifolium</i>	<i>E. stolonifera</i>
<i>H. alienatum</i>	<i>Hermannia linifolia</i>
<i>Nestlera humilis</i>	<i>Asparagus suaveolens</i>
<i>Galenia africana</i> var. <i>africana</i>	<i>Garuleum bipinnatum</i>
<i>Crassula portulacea</i>	<i>Cotyledon reticulata</i>
<i>C. rupestris</i>	<i>Felicia muricata</i>
<i>C. subsessilis</i>	<i>Galenia fruticosa</i> var. <i>prostrata</i>
<i>Tetragonia fruticosa</i>	<i>Osteospermum</i> <i>microphyllum</i>
<i>Blepharis capensis</i>	<i>Adromischus sphenophyllum</i>
<i>Helichrysum zeyheri</i>	<i>Haworthia foliosa</i>
<i>Pelargonium ramosissimum</i>	<i>H. deltoidea</i>
<i>P. squarrosum</i> and others	<i>H. rubriflora</i>
<i>Pteronia flexicaulis</i>	<i>Sericocoma avolans</i>
<i>Sarcocaulon spinosum</i>	<i>S. pungens</i>
<i>Osteospermum sinuatum</i>	<i>Monechma pseudopatulum</i>
<i>Pachypodium succulentum</i>	<i>Dicoma spinosa</i>
<i>Cotyledon decussata</i>	
<i>Salsola zeyheri</i>	

and many more.

Of the mesembs, we can only name a few; this list does not claim to include even all of the common species. Many of them are very local in their distribution, e.g. only on patches of quartz gravel, or only in rock crevices on the hilltops:—

<i>Spalmanthus blandus</i>	<i>Mesembryanthemum</i> <i>karrooense</i>
<i>S. vigilans</i>	<i>Psilocaulon utile</i>
<i>S. defoliatus</i>	<i>P. absimile</i>
<i>Aridaria noctiflora</i>	<i>P. simile</i>
<i>Brownanthus ciliatus</i>	<i>Rhinophyllum</i> <i>macradenium</i>
<i>Cephaelophyllum</i> <i>curtiphyllum</i>	<i>R. luteum</i>
<i>C. vandermerwei</i>	<i>Ruschia multiflora</i>
<i>Cerochlamys pachyphylla</i>	<i>R. caroli</i>
<i>Conophytum petreum</i>	<i>R. ferox</i>
<i>Delosperma pageanum</i>	



FIG. 54.—The Little Karoo (26b) south of Ladismith in the Cape. Species noted: *Euclea undulata* on the hills and *Salsola* spp., mesembs and *Pteronia pallens* on the plains.



FIG. 55.—The Little Karoo (26b) between Ladismith and Laingsburg in the foothills of the Swartberg, Cape. Species present: *Euclea undulata*, *Acacia karroo*, *Galenia africana*, *Euphorbia mauritanica* mesembs and *Pteronia pallens*.

D. subinicanum  
*Gibbaeum shandii*  
*G. perviride*  
*G. pubescens*  
*Glotiphyllum fragrans*  
*Hereroa latipetala*  
*H. stanleyi*  
*H. odorata*  
*Hymenoculus* spp.  
*Lampranthus* *haworthii*  
*L. henricii*  
*L. uniflorus* var. *spathulatus*  
*Leipoldtia* spp.

R. stellata  
*R. aculeata*  
*R. montagueensis*  
*R. laxipetala*  
*R. fourcadei*  
*Sceletium* spp.  
*Trichodiadema barbatum*  
*Drosanthemum hispidum*  
*D. delicatulum*  
*D. lique*  
*D. speciosum*  
*D. bredai*

and many more.

Grasses are inconspicuous in this veld type, though where the veld is rested for some years, they begin to reappear, e.g. along the National Road near Laingsburg:

*Eragrostis spinosa* W  
*Stipagrostis namaquensis* W  
*S. brevifolia* w  
*S. ciliata*  
*S. obtusa*

*A. congesta* subsp. *congesta*  
*Enneapogon desvauxii*  
*E. scaber*  
*Ehrharta calycina*  
*Hyparrhenia hirta*

As has been said, the Little Karoo is rocky and hilly, odd looking country in the western part, where it is a maze of even-sized, brown, stony little hills. This type of topography increases the effect of the rainfall by concentrating run-off from the

rocks into pockets of soil and it provides a variety of habitats, inducing a varied flora. On the higher hills and ridges, *Elytropappus rhinocerotis* is regularly present, and round the margins of the Little Karoo becomes important in the transitions to Mountain Rhenosterbosveld and Fynbos. It is accompanied, in the Little Karoo, by such species as:

<i>Cotyledon paniculata</i>	<i>Euphorbia mauritanica</i>
<i>C. wallichii</i>	<i>E. burmannii</i>
<i>Rhus lucida</i>	<i>Euryops tenuissimus</i>
<i>Rhus rosmarinifolia</i>	<i>Euryops lateriflorus</i>
<i>Euclea undulata</i>	<i>E. imbricatus</i>
<i>E. tomentosa</i>	<i>Polygala myrtifolia</i>
<i>Pteronia fasciculata</i>	<i>Zygophyllum flexuosum</i>
<i>P. flexicaulis</i>	<i>Dodonaea viscosa</i> var. <i>angustifolia</i>
<i>P. paniculata</i>	<i>Berkheya fruticosa</i>
<i>P. pallens</i>	<i>Ruschia multiflora</i>
<i>P. incana</i>	<i>R. cymosa</i> and other <i>shrubby</i> spp.
<i>Relhania squarrosa</i>	<i>Ehrharta calycina</i>
<i>R. genistaefolia</i>	<i>Lebeckia cytoides</i>
<i>Galenia africana</i> var. <i>africana</i>	

forming the 0,6—8,1 m scrub which is so characteristic of the less arid Little Karoo hillsides. Outliers of it occur as narrow belts and patches on the slopes of the Klein Roggeveld mountains and of the Roggeveld escarpment (included in the Western Mountain Karoo on the map); in the Olifants River valley

south of Clanwilliam; on the slopes of the Piquetberg and Olifants River mountains and in the Doorn River valley north-east of Clanwilliam, linking the Karroid Broken Veld of eastern origin, with the Namaqualand Broken Veld of north-western and central origin. This applies to the usually shaly mountain slopes and ridges, but on sandstone there is a transition direct to Arid Fynbos; this geological differentiation is well seen in the Doorn River Valley below Pakhuis Pass, where the Little Karoo scrub on shale may occur above the Arid Fynbos on sandstone.

Round the margins of the Little Karoo, especially in the Robertson Karoo, the bush is often quite dense and tends to develop into clumps, the botanical composition of which leaves no doubt about the relationship of this veld to the Succulent Bushveld. These bush clumps occupy low mounds, but, so far as has been noticed, they are not associated with termitaria, appearing rather to start as clumps of *Euphorbia mauritanica*, which, by its relatively tall growth and denseness right down to ground level, catches and holds wind-blown soil, so building up a mound.

On dry plains at higher levels, e.g. around Touws River, we find a transition to Mountain Rhenosterbosveld and even Western Mountain Karoo, via a semi-succulent, open karroid Rhenosterbosveld.

The thornveld along the rivers is particularly well developed, sometimes almost a forest of tall *Acacia karroo*, with *Rhus lancea*, *Salix capensis*, *Rhus pyroides*, *Buddleia saligna*, *Freylinia lanceolata*, *Phragmites australis*, *Diospyros pallens*, *Nicotiana glauca* and the climbers, *Clematis* sp., *Zygophyllum foetidum* and *Asparagus* spp.

#### (c) Grassy Mountain Scrub

(See Marloth, II, 2, Pl. 78)

In the Little Karoo, up the sides of the mountains, this semi-succulent scrub becomes non-succulent, with *Dodonaea viscosa* var. *angustifolia*, *Acacia karroo*, and *Rhus lucida* in Rhenosterbosveld. At the margin of the Great Karoo, however, we find a different type of scrub, also largely non-succulent, but very grassy. It is related to the non-succulent scrub associated with the Spekboomveld, but extends beyond the limits of that veld type into the wetter and cooler regions along the mountains from the Bokkeberg and Bankberg to the Camdebooberg and Sneeuberg, and again on the eastern part of the Nieuwveld Range. In these parts it is transitional, not to Mountain Rhenosterveld and Fynbos, but to Karroid *Merxmullera* Mountain Veld and is very grassy. On southern aspects it is a dense, grassy scrub, on northern aspects it is a grassveld dotted with shrubs, usually, in varying degrees, invaded by Karoo and rhenosterbos. The shrubs of the normal Karroid Broken Veld nearly all occur, but there are important additions, e.g.:—

<i>Olea africana</i>	<i>Dodonaea viscosa</i> var. <i>angustifolia</i>
<i>Grewia occidentalis</i>	<i>Cussonia paniculata</i>
<i>Myrsine africana</i>	<i>Osyris lanceolata</i>
<i>Kiggelaria africana</i>	<i>Maytenus undata</i>
<i>Celtis africana</i>	<i>Aloe ferox</i> (sometimes)
<i>Tarchonanthus minor</i>	<i>Rhamnus prinoides</i>
<i>Rhus lucida</i>	<i>Buddleia glomerata</i>
<i>R. erosa</i> (north-eastwards)	<i>Pittosporum viridisflorum</i>

The dominant grass is *Aristida diffusa* var. *burkei*, associated with the following species:—

<i>Eragrostis chloromelas</i>	<i>Fingerhuthia africana</i>
<i>Sporobolus fimbriatus</i>	<i>Enneapogon scoparius</i>
<i>Heteropogon contortus</i>	<i>Themeda triandra</i>
<i>Eustachys mutica</i>	<i>Merxmullera disticha</i> L
<i>Setaria neglecta</i>	<i>Ehrharta calycina</i>
<i>Cymbopogon plurinodis</i>	and others

#### 27 CENTRAL UPPER KAROO

(See Marloth, III, 2, Pl. 62)

This is a well marked veld type occupying the central part of the upper plateau south of the Orange River, at altitudes ranging from 1 050—1 700 m above the sea, and receiving 200—250 mm of rain per annum, the rainy season being in late summer. It is flat country dotted with dolerite hills and ranges of hills and mountains, especially south-westwards. In general the plains are stony (shale, sandstone and calcareous tufa), though sometimes covered with shallow red, sandy loam, and there are wide, silty flats or flood plains along the rivers.

The hills and mountains are more grassy than the plains, but there is not the great difference that there is in the False Karoo. The tops of the higher mountains are Karroid *Merxmullera* Mountain Veld. The vegetation is a fairly grassy Karoo (the grasses being of the "white" type and represented to-day mainly by *Eragrostis lehmanniana* and *Aristida congesta*, subsp. *congesta* with bigger shrubs (*Lycium* spp., *Rhigozum trichotomum*) mainly on the flood plains of the rivers and on and around the hills. The characteristic shrub of the hills themselves is *Rhus undulata* var. *tricrenata*. On the plains, the flora is regularly richer in the stony parts than elsewhere, while the occasional patches of loose sand amongst the hills carry an *Aristida diffusa* var. *burkei*-*Eriocephalus ericoides* veld rather of Kalahari Thornveld type. The flood plains sometimes retain a very dense, grassy, short Karoo. The only succulent of general importance is *Ruschia ferox*, but a number of mesembs and other succulents are regularly present as rarities.

The whole of this veld type is to some degree invaded by elements of the Arid Karoo and sheet eroded. Typical species (excluding grasses) include:—

<i>Eriocephalus ericoides</i>	<i>Salsola nigrescens</i>
<i>E. spinescens</i>	<i>S. rabciana</i>
<i>E. pubescens</i>	<i>Felicia ovata</i>
<i>Pentzia globosa</i>	<i>Limeum aethiopicum</i> subsp. <i>aethiopicum</i>
<i>P. spinescens</i>	<i>Gnidia polycyphala</i>
<i>P. incana</i> (on limestone)	<i>Moraea polystachya</i>
<i>P. lanata</i>	<i>Homeria pura</i>
<i>P. incana</i> (ankerkaro)	<i>Geigeria ornativa</i>
<i>P. sphaerocephala</i>	<i>Osteospermum spinescens</i> W
<i>Plinthus karooicus</i>	<i>O. leptolobum</i>
<i>Nenax microphylla</i>	<i>Helichrysum lucilioides</i>
<i>Pteronia glauca</i>	<i>Hermannia multiflora</i>
<i>P. erythrochaeta</i> W	<i>Microloma massonii</i>
<i>P. glaucescens</i> W	<i>Sutera pinnatifida</i>
<i>P. glomerata</i>	<i>S. atropurpurea</i>
<i>Nestlera humilis</i>	<i>S. halimifolia</i>
<i>N. conferta</i>	<i>Lightfootia tenella</i>
<i>N. prostrata</i>	<i>Drosanthemum lique</i> t
<i>Rosenia glandulosa</i>	<i>Felicia filifolia</i>
<i>Pegolettia retrofracta</i>	<i>Osteospermum scariosum</i>
<i>Felicia muncata</i>	<i>Sceletium</i> sp.
<i>Chrysocoma tenuifolia</i>	<i>Rhus undulata</i> var. <i>tricrenata</i>
<i>Tetragonia arbuscula</i>	<i>Helichrysum pentzioides</i> W
<i>Kochia pubescens</i> W	<i>Othonna pavonia</i> W
<i>Suaeda fruticosa</i> W	<i>Asparagus stipulaceus</i>
<i>Lycium prunus-spinosa</i> W	<i>Euphorbia acqueris</i>
<i>L. arenicolum</i> W	<i>Lessoria pauciflora</i> var. <i>schlechteri</i>
<i>Phymaspernum aciculare</i>	
<i>Salsola glabrescens</i> W	
<i>Thesium hystric</i>	

*Geigeria ornativa* formerly caused losses of stock in this region, but to-day it is quite a rare plant, occurring in depressions, where it receives a little extra water; another indication of climatic deterioration.

The short, dense veld of the flood-plains takes two forms: (i) dense, short grassveld; (ii) dense, short karoo.

(i) The grasses are mainly *Eragrostis bicolor*, and *S. acinifolius*, with more or less *Panicum stapfianum*, and, in higher parts, *Eragrostis bergiana*. It can be surprising and instructive, when travelling along a dry road through a dry countryside, to come upon one of these grassy vleis with a layer of more or less clear water trickling through it, coming down from some place that had a good storm the previous day. Had there been a donga instead of a grassy vlei, the water would have been gone in an hour or two, and it would not have done anything more useful than freshen up a few *Lycium* bushes.

(ii) The principal species are:—

<i>Pentzia incana</i> (ankerkaroo)	<i>Pteronia erythrochaeta</i>
<i>Felicia muricata</i>	<i>P. sordida</i>
<i>Salsola nigrescens</i>	<i>P. glomerata</i>
<i>S. tuberculata</i> subsp. tuberculata (sometimes)	<i>Plinthus karrooicus</i>
<i>Nestlera humilis</i>	<i>Gnidia polyccephala</i> (sometimes)
<i>N. conferta</i>	<i>Asparagus</i> sp. (stiff, glaucous, spiny)
<i>Gazania krebsiana</i> subsp. arctotoides	<i>Eberlanzia vulnerans</i>
<i>Pentzia spinescens</i>	<i>R. uncinella</i>
<i>P. lanata</i>	<i>Aster</i> sp. = A 12 598
<i>Lycium oxycladum</i>	<i>Felicia ovata</i>
<i>Walafrida geniculata</i>	<i>Aridaria</i> sp. cf. <i>A. noctiflora</i>
<i>Eragrostis bergiana</i>	<i>Geigeria ornativa</i>
<i>Zygophyllum microphyllum</i>	

and many more.

There is a strong resemblance between this veld and the corresponding veld of the Central Lower Karoo. The interesting thing is that little patches of this dense, well-mixed Karoo will occur in what is otherwise a "vloer", giving us another clear indication of what the former grazing value of the veld was.

The grasses of the Central Upper Karoo include:—

<i>Eragrostis lehmanniana</i>	<i>Setaria verticillata</i> k
<i>E. obtusa</i>	<i>Stipagrostis namaquensis</i> W
<i>E. bergiana</i>	<i>Enneapogon desvauxii</i>
<i>E. bicolor</i> W	<i>Digitaria argyrograppa</i>
<i>E. nindensis</i>	<i>Fingerhuthia africana</i>
<i>E. curvula</i>	<i>F. sesleriiformis</i> W
<i>Aristida diffusa</i> var. <i>burkei</i>	<i>Agrostis lachnantha</i> W
<i>A. congesta</i> subsp. <i>barbicollis</i>	<i>Oropetium capense</i>
<i>A. congesta</i> subsp. <i>congesta</i>	<i>Sporobolus fimbriatus</i>
<i>A. adscensionis</i>	<i>S. ludwigii</i> W
<i>Stipagrostis obtusa</i>	<i>Schismus barbatus</i>
<i>S. ciliata</i>	<i>Phragmites australis</i> W

The response of *Phragmites* along the rivers to a few years rest from grazing is remarkable.

Little information is available as yet about the flora of the mountains.

## 28 THE WESTERN MOUNTAIN KAROO

This veld type occupies very stony country, mostly shale, fine grained sandstone and granite, with a topography ranging from gently undulating to steeply rolling. Rocky outcrops are few; here occurs a transition to Little Karoo on the one hand and to Namaqualand Broken Veld on the other. Soil is conspicuous by its absence, except in some of the valleys and flatter parts; but it must be remembered that this region is amongst the oldest settled in the Cape Province, so that erosion has had ample opportunity to remove the last patch of erodible soil.

The resulting absence of visible erosion gives one in this veld type, a pleasing impression of stability, even though one realizes that it is at a lower level of productivity than it was when the Bushmen were raiding the early European settlers' flocks and herds 180 years and more ago.

It has two variations: (a) The upper, or typical form is a tall, almost non-succulent Karoo. It merges into the Central Upper Karoo in the neighbourhood of Fraserburg, from there stretching westwards along the gentle northern slopes of the Roggeveld mountains, and northwards along the Hantamsberg to the Loeriesfontein area and thence in patches on the higher mountains through Namaqualand. This is the wetter and cooler form, at elevations of 900—1 700 m above the sea, and receiving 150—250 mm of rain per annum. It borders on the winter rainfall area eastwards, extending into it north-westwards. Upwards it merges into the Mountain Rhenosterveld, or into the non-succulent variation of Namaqualand Broken Veld; (b) The lower, or semi-succulent form. At lower elevations and in drier country, along the south-western foot of the Roggeveld mountains, between Calvinia and Nieuwoudtville, and north of Loeriesfontein, is this shorter, semi-succulent form, which tends to break down into weedy succulent Karoo, with much *Salsola zeyheri*. It ranges in altitude from 600—1 000 m above sea-level and receives 150 mm and less of rain mostly in winter.

(a) *Upper Form*.—The bushes grow up to 1 m high, even *Pentzia incana*, which in the Central Upper Karoo and Central Lower Karoo, is usually only 5–15 cm high. Its lower branches continue to "anchor", however, even though its upper branches may be inclined to adopt the spinescence of *Pentzia spinescens*. This is the dominant and characteristic bush of this veld type, except on excessively overgrazed hillsides, e.g. around Loeriesfontein, where *Galenia africana* var. *africana* becomes the dominant.

Typical species include:—

<i>Pentzia</i> sp. = A. 14409	<i>Hermannia trifurca</i> (Namaqualand)
<i>Galenia africana</i> var. <i>africana</i>	<i>Pteronia divaricata</i>
<i>Eriocephalus</i> sp. = A. 14 407	<i>Atriplex vestita</i>
<i>E. ericoides</i>	<i>Ruschia ferox</i>
<i>Pteronia glauca</i>	<i>R. tuberculosa</i> (sometimes)
<i>P. glomerata</i>	<i>Drosanthemum ambiguum</i>
<i>P. incana</i> (Namaqualand)	<i>D. lique</i>
<i>Zygophyllum giffillanii</i>	<i>Asparagus capensis</i>
<i>Salsola zeyheri</i> (sometimes)	<i>Galenia fruticosa</i> var. <i>prostrata</i>
<i>S. rabieana</i> (sometimes)	<i>Hippocratea alienatum</i>
<i>Eriocephalus pubescens</i>	<i>Nestlera humilis</i>
<i>Pelargonium</i> sp. = A. 14 118	<i>Osteospermum sinuatum</i>
<i>Euphorbia mauritanica</i>	<i>Cotyledon wallichii</i>
<i>E. stolonifera</i>	<i>Asaemia axillaris</i>
<i>E. multiceps</i>	<i>Lycium</i> spp.
<i>Nestlera prostrata</i> (Roggeveld)	<i>Pterothrix spinescens</i>
<i>Walafrida articulata</i> (Roggeveld)	<i>Senecio</i> sp. = A. 12 617
<i>Lebeckia spinescens</i> (Namaqualand)	<i>Chrysocoma tenuifolia</i>
<i>Lightfootia thunbergiana</i> (Namaqualand)	<i>Zygophyllum microphyllum</i>
	<i>Helichrysum hamulosum</i>
	<i>Stomatium pyrorodium</i>
	<i>Aloinopsis malherbei</i>
	<i>Salvia rugosa</i>

Perennial grasses other than *Ehrharta calycina* and rarely *Merxmuellera stricta*, are very scarce in this veld type in its present condition (Fig. 57).

Numerous patches of this veld type occur around the Kamiesberg on flattish parts of the higher ridges between the valleys, but too small and scattered to be mapped on a small scale. Many of them, where the gravelly soil is deep enough, have been ploughed up for growing wheat.



FIG. 56.—Upper Form (28a) of Western Mountain Karoo near Bulletrap School in Namaqualand. Species noted: *Eriocephalus xerophilus*, *Zygophyllum retrofractum*, *Peutzia globosa*, *Felicia filifolia*, *Hippocratea alienatum*, *Ruschia* spp., *Galenia fruticosa* var. *prostrata*, *Chrysocoma tenuifolia* etc.



FIG. 57.—*Stipagrostis obtusa*, klein boesmansgras, in the Western Mountain Karoo (28) south west of Fraserburg in the Cape.

(b) Lower Form.—Exactly the same species occur in this form (Fig. 58), though of normal stature and perhaps in different proportions, e.g. *Salsola zeyheri* tends to be common, but the mesembs are commoner and more species occur, in excessively overgrazed parts becoming dominant, e.g.:—

<i>Drosanthemum eburneum</i>	M. sp.
<i>Ruschia leucosperma</i>	<i>Malephora framesii</i>
<i>R. pumila</i>	M. spp.
<i>R. sp. cf. R. kakamasensis</i>	<i>Brownanthus ciliatus</i> .
<i>R. robusta</i>	<i>Leipoldtia constricta</i>
<i>R. fugitans</i>	<i>Lampranthus fluminiflorus</i> var. <i>spathulatus</i>
<i>Aridaria calycina</i>	<i>L. godmaniae</i>
<i>Sphaeralanthus rhodandrus</i>	<i>L. watermeyeri</i>
<i>Psilocaulon utile</i>	
<i>Mesembryanthemum annum</i>	

and a lot more. The worst parts of this veld type, e.g. at the edge of the Tanqua Karoo and north and north-west of Loeriesfontein along the trek path into Bushmanland, have become virtually desert. Here we find an extraordinary effect of excessive grazing pressure—the karoo-bushes of various species have been forced all to adopt exactly the same habit, a dense, woody, thorny, tangled “cushion”, with a few leaves inside the cushion. To determine them, one has to examine the leaves, no longer being able to recognize each species by its distinctive habit of growth.

## 29 THE ARID KAROO (See Hutchinson, p. 181)

This veld type, and the Succulent Karoo, occupy the driest parts of the Republic, with a rainfall ranging from about 50–200 mm per annum. The altitude of the Arid Karoo is mostly about 900 m above the sea, sloping gently up to 1 200 m along the southern margin and down to 450 m along the edge of the Orange River valley in the north. The rain falls mostly in autumn, but is extremely erratic; it has been said that there is plenty of rain in Bushmanland, but it takes five years to get round to any particular farm. The country is extremely flat, with few hills, except in the southern portion along the northern foot of the Roggeveld mountains, where it undulates across the valleys of the Sak River and its numerous tributaries, all draining northwards into the Orange River. In their lower courses these rivers form enormous brak, silty flats, the “vloere”, in some cases covered with Ganna-veld (*Salsola aphylla* and other species), e.g. much of the Groot Vlocr; in other cases practically bare, e.g. Verneuk Pan. In the 25 km length of Verneuk Pan, the fall is said to be 150 mm. It is said, also, that after rains the thin layer of water which spreads over this flat surface is blown from side to side by the wind, producing a fine mud.



FIG. 58.—The Lower Form (28b) of Western Mountain Karoo in the Bloukrans Pass, south of Calvinia in the Cape. Species noted: *Euphorbia mauritanica*, *Rhus undulata*, *Galenia africana*, *Cotyledon paniculata*, *C. wallichii*, *Monechria pseudopatulum*, *Pteronia incana*, *P. divaricata* and *Euphorbia decussata*.

The country in general is no flatter than the western half of the Orange Free State or the Standerton area, but it gives a curious impression of convexity, as though it were a flat wide ridge, over the edge of which one cannot see; this impression has given the name Die Bult to a belt of country stretching south-east from Kenhardt and including the Kaiingbulte; but that part of Bushmanland west of the Sak River gives the same impression, and is, in fact, a region of internal drainage into numerous pans and vloere. This limited visibility is assisted by mirage and the fact that the complete circle of the horizon may be unbroken by even a rock. Westwards one may get an occasional glimpse of a distorted mirage, of the tips of the Kamiesberg peaks, wavering in the sky.

The Arid Karoo is by nature, an even grassier region than the Central Upper Karoo, but the chief grasses are silvery white desert species. In parts, because they can regenerate from seed more quickly and certainly than the karoo bushes, they have become the only perennial plants. Species of karoo bushes are plentiful, though sparser than in the Central Upper Karoo; but larger shrubs are rare and entirely absent over large areas.

There are three main variations:—

(a) Blomkoolganna veld (*Salsola tuberculata* subsp. *tuberculata*) of calcareous tufa mostly along the northern edge of the plateau.

(b) Driedoring veld (*Rhigozum trichotomum*) of gravelly and stony soil, mostly in the central part.

(c) semi-succulent Karoo of calcareous tufa and stony soil in the southern part, south of the Carnarvon-Calvinia main road.

#### (a) Blomkoolganna Veld

It is likely that this is the climax of the whole of the Arid Karoo, but it has persisted best on sandy calcareous tufa, which occurs mainly in a belt along the north-eastern and northern borders of the veld type on granite, not extending much south of the Kenhardt-Pofadder road along the north border, but all down the north-eastern border between the Doornberg and the Hartebeest River, to the neighbourhood of Frieska Poort. In some parts the tufa is covered with a layer of granite gravel. The veld is typically a uniform and fairly dense growth of

*Salsola tuberculata* subsp. *tuberculata* (Fig. 59) with *Stipagrostis obtusa* and *S. ciliata*, and no other dominants, though the flora is quite rich. The ground is often surprisingly well covered also with short grasses, mainly *Enneapogon desvauxii*, *Eragrostis nindensis*, *Sporobolus lampranthus*, *Oropetium capense* with *Stipagrostis brevifolia* in sandy depressions westwards. *Enneapogon* is short lived, though its dead tufts persist; *Oropetium* is too small to provide much cover; but the other two are perennials growing into mats up to 45 cm in diameter, but so short that in dry times the sand will drift over them, giving the impression that there is no grass at all. *Stipagrostis brevifolia* is the hardiest of all the plants of the Arid Karoo, in droughts shedding its leaves and curling up into a little woody yellow-brown bush, even in parts where no other perennial survives. Annuals and geophytes are plentiful, though not so showy as those of Namaqualand. They include a fern, *Ophioglossum polyphyllum*. On the rare koppies and rocky outcrops, the vegetation is Namaqualand or Orange River Broken Veld, with a fringe of *Rhigozum trichotomum*. This shrub appears to be invading the blomkoolganna veld. Overgrazing, especially in the less arid parts, e.g. Die Bult, will tend to encourage other karoo bushes at the expense of *Salsola tuberculata* subsp. *tuberculata* producing a more mixed veld, but at the same time encouraging *Rhigozum trichotomum*.

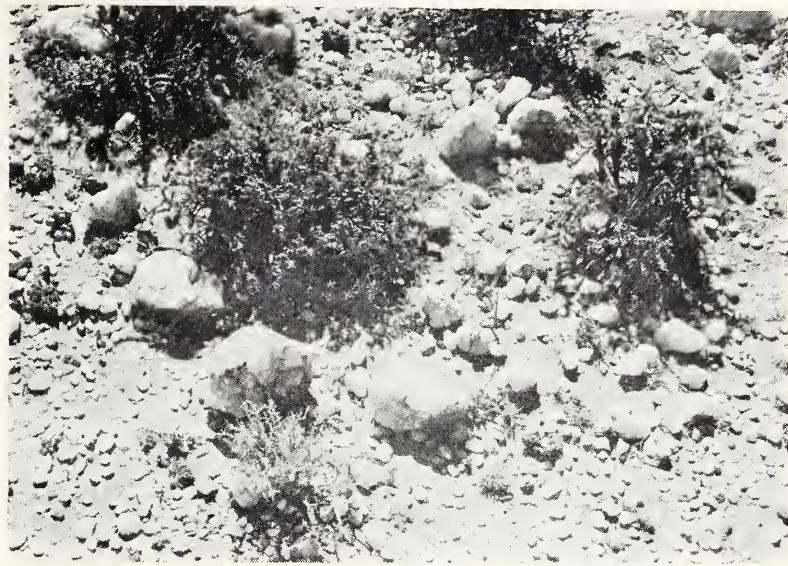
Non-grasses of general occurrence are:—

<i>Salsola tuberculata</i>		<i>Pteronia glomerata</i>	452
subsp.		<i>Lycium oxycladum</i>	378
<i>tuberculata</i> .....	10 331	<i>Aptosimum</i>	
<i>Pentzia spinescens</i> ..	4 531	<i>spinescens</i> .....	348
<i>Eriophyllum</i>		<i>Ruschia ferox</i> .....	221
<i>spinescens</i> .....	1 649	<i>Dicoma capensis</i> ..	175
<i>Zygophyllum</i>		<i>Eriophyllum</i>	
<i>microphyllum</i> ....	981	<i>pubescens</i> .....	51
<i>Hermannia spinosa</i>	663	<i>Moraea</i> sp. = A.	
<i>Nestlera humilis</i> ...	619	12 611.....	9
<i>Salsola glabrescens</i>	610	<i>Sarcocaulon</i>	
<i>Rhigozum</i>		<i>patersonii</i> .....	2
<i>trichotomum</i> ....	496		

Non-grasses of less general occurrence include:—

<i>Acanthopsis hoffmannseggiana</i>		<i>Limeum aethiopicum</i> subsp.	
<i>Aizoon schellenbergii</i>		<i>aethiopicum</i>	
<i>Aptosimum depressum</i>		<i>Pteronia glauca</i>	
<i>A. steingroeveri</i>		<i>P. inflexa</i>	

FIG. 59.—Bloukoolganna Veld (29a) at Jagbult, west of Prieska in the Cape. Species present: *Salsola tuberculata* subsp. *tuberculata* and *Pentzia spinescens*.



Berkheya annectens  
Eriocaphalus sp. = A.  
12 634  
Geigeria ornativa  
Tribulus terrestris  
Zygophyllum giffillani  
Osteospermum armatum  
Monechma desertorum  
Pentzia pinnatisecta  
and many more.

P. mucronata  
Pteronia leucoclada  
Lycium arenicolum h  
L. prunus-spinosa h  
L. austrinum k  
Phaeoptilum spinosum  
Plinthus karroicus  
Polygala seminuda  
Selago minutissima

Grasses of general occurrence are:—  
*Stipagrostis obtusa* 111 526      *Stipagrostis ciliata*.. 16 942  
*Enneapogon desvauxii*..... 64 624      *Eragrostis nindensis* 11 008

These are surprising figures when one compares them with the figures for the northern grassveld types and the bushveld types. They are supported, however, by Tidmarsh Wheel analyses made at Jagbult on Die Bult and at Toowoomba Research Station in the Sourish Mixed Bushveld, which showed that basal cover at Jagbult (6·9 per cent) was actually higher than at Toowoomba (5·8 per cent).

Grasses (including annuals) of less general occurrence are:—

<i>Stipagrostis brevifolia</i>	<i>E. porosa</i>
<i>Aristida congesta</i> subsp. congesta	<i>Tragus racemosus</i>
<i>A. adscensionis</i>	<i>Schmidtia kalahariensis</i>
<i>Sporobolus lampranthus</i>	<i>Enneapogon scaber</i>
<i>Eragrostis annulata</i>	<i>Oropetium capense</i>
<i>E. homomalla</i>	<i>Panicum lanipes</i>
	<i>Stipagrostis anomala</i>

Annuals and geophytes are very numerous and important after good rains, which means that they are rarely seen in quantity; they include:—

<i>Aizoon canariense</i>	<i>Indigofera argyraea</i>
<i>Radyera urens</i>	<i>Lepidium desertorum</i>
<i>Amellus strigosus</i>	<i>Limeum argute-carinatum</i>
<i>Androeymbium bellum</i>	var. <i>kweweeneye</i>
<i>A. roseum</i>	<i>Lotononis platycarpa</i>
<i>Arctotis staechadifolia</i>	<i>Manulea fragrans</i>
<i>Babiana hypogaea</i>	<i>Medicago aschersoniana</i> h & w
<i>Diascia engieri</i>	<i>Oxalis beneprotecta</i>
<i>Dimorphotheca polyptera</i>	<i>Ophioglossum polypodium</i>
<i>Dipcadi spp.</i>	<i>Pentzia annua</i>
<i>Eriospermum spp.</i>	<i>Walafrida minuta</i>
<i>Euphorbia inaequilatera</i>	<i>Sesamum capense</i>
<i>Galenia sarcophylla</i>	<i>Sutera tristis</i>
<i>Gnaphalium glomerulatum</i>	<i>Ursinia nana</i>
<i>Helichrysum spp.</i>	<i>Zaluzianskya diandra</i>
<i>Heliophila trifurcata</i>	<i>Zygophyllum simplex</i>
<i>Hermannia paucifolia</i>	<i>Bergia anagalloides</i>
<i>Ifloga paronychioides</i>	

It is likely that the prickly and inedible *Osteospermum armatum* will become of increasing importance in the future, in the Driedoring veld too.

The total number of species in the Relative Abundance Table is 284.

#### (b) The Driedoring Veld

This is stony veld, mostly on Dwyka shales and tillite and Ecca shales, ranging in colour from brown to black. The soil, what there is of it, is silty rather than sandy or gravelly.

Almost the whole of this form of the Arid Karoo has been reduced by the trek boer to virtual desert; and, in its dark, featureless desolation and its shimmering heat and mirages, it is not attractive country.

Here and there one finds parts where *Salsola tuberculata* subsp. *tuberculata* is still the dominant bush, with abundance of *Stipagrostis obtusa* and sometimes, westwards, *S. brevifolia*, and wherever there is calcareous tufa. The general bareness of this veld is not a natural condition, but rather the result of continuous grazing and the excessive heating of the exposed dark surface. The generally dominant bush is *Pentzia spinescens*, with *Eriocaphalus spinescens* important in the dark stony parts, with *Zygophyllum microphyllum*, *Pteronia leucoclada* and *Salsola zeyheri* usually very sparse. *Rhigozum trichotomum* tends to occur in patches and narrow belts, forming more or less a honeycomb pattern (Fig. 60). Succulents are sometimes fairly common, e.g. *Ruschia ferox*, *R. leucantha* and *R. muricata*, besides the temporary *Psilocaulon* spp. of the pans and "vloere", increasing in importance in those parts which we have separated as False Succulent Karoo.

Non-grasses of general occurrence are:—

<i>Pentzia spinescens</i>	4 118	<i>Zygophyllum</i>
<i>Salsola tuberculata</i>		<i>giffillani</i> ..... 856
subsp.		<i>depressum</i> ..... 701
<i>tuberculata</i> ..... 2 892		<i>Aptosimum</i>
<i>Galenia sarcophylla</i> 2 851		<i>depressum</i> ..... 650
<i>Ruschia ferox</i> ..... 1 824		<i>Pteronia muconata</i> 517
<i>Eriocaphalus</i>		<i>Hermannia spinosa</i>
<i>spinescens</i> ..... 1 739		<i>ericoides</i> ..... 514
<i>Zygophyllum</i>		<i>Pteronia glomerata</i> 314
<i>microphyllum</i> .... 1 662		<i>Tetragonia</i>
<i>Rhigozum</i>		<i>arbuscula</i> ..... 53
<i>trichotomum</i> .... 882		<i>Lycium arenicolum</i> 35



FIG. 60.—Driedoring Veld (29b) in the Jakkalstoring area, north of Williston in the Cape. Species noted: *Rhigozum trichotomum*, *Pentzia spinescens*, *Salsola tuberculata* subsp. *tuberculata*, *Pteronia mucronata*, *Zygophyllum microphyllum*, *Erioccephalus spinescens* and silvery *Stipagrostis obtusa* in middle distance.

Non-grasses of less general occurrence are:—

<i>Leyssera tenella</i> ...	1 618	<i>Pteronia glauca</i> ....	245
<i>Gazania lichensteinii</i> ....	1 447	<i>Psilocaulon absimile</i> .....	236
<i>Mesembryanthemum annuum</i> .....	1 055	<i>Nestlera humilis</i> ....	227
<i>Salsola zeyheri</i> ....	1 007	<i>Dimorphotheca polypetra</i> .....	217
<i>Zygophyllum simplex</i> .....	823	<i>Aptosimum spinescens</i> ....	136
<i>Sphalanthus tetragonus</i> .....	625	<i>Dicoma capensis</i> ..	118
<i>Aptosimum steingroeveri</i> ....	464	<i>Helichrysum lucilioides</i> .....	89
<i>Gazania</i> spp. ....	464	<i>Mesembryanthemum sp.</i> .....	78
<i>Osteospermum sinuatum</i> .....	455	<i>Osteospermum armatum</i> .....	50
<i>Aridaria</i> sp. §.		<i>Lebeckia spinescens</i> ....	20
<i>Noctiflora</i> .....	373	<i>Pteronia leucoclada</i> ....	15
<i>Limeum aethiopicum</i> subsp. <i>aethiopicum</i> .....	366	<i>Euphorbia rectirama</i> .....	14
<i>Felicia hyssopifolia</i>	347	<i>Pteronia inflexa</i> ....	14

and many more.

Grasses of general occurrence are:—

<i>Stipagrostis obtusa</i>	20 997	<i>Aristida</i>	
<i>S. ciliata</i> .....	12 662	<i>adscensionis</i> ....	805
<i>Enneapogon desvauxii</i> .....	10 381		

Grasses of less general occurrence are:—

<i>Aristida congesta</i> subsp. <i>congesta</i> ..	1 841	<i>Fingerhuthia africana</i> .....	256
<i>Stipagrostis anomala</i> .....	349	<i>Stipagrostis namaquensis</i> ....	12

At times annuals are abundant, but the writer has not seen this part of the country after good and sustained rains.

In 1939 a survey was made of the tramped-out, though partially rested farm, Rietkolk Oos, 15 km north of Brandvlei, and an actual count made of the plants occurring within 1 219 four-foot (1.2 m) quadrats distributed along a zig-zag line at 100 pace intervals. The figures worked out as per morgen (0.857 ha), may be of interest:—

<i>Stipagrostis obtusa</i>	5 454	<i>Pteronia mucronata</i>	129
<i>Salsola tuberculata</i> subsp. <i>tuberculata</i> .....	3 001	<i>P. sp.</i> .....	124
<i>Pentzia spinescens</i> ....	2 738	<i>Asparagus compactus</i> .....	115
<i>Zygophyllum microphyllum</i> ....	2 199	<i>Lycium oxycladum</i>	111
<i>Z. giffillanii</i> .....	1 343	<i>Psilocaulon sp.</i> ....	97
<i>Erioccephalus spinescens</i> .....	1 240	<i>Hermannia paucifolia</i> .....	74
		<i>Polygala seminuda</i>	74
		<i>Pteronia inflexa</i> ...	69

<i>Enneapogon desvauxii</i> .....	1 208	<i>Trianthemum triquetra</i> subsp. <i>parvifolia</i> .....	55
<i>Rhigozum trichotomum</i> ....	1 028	<i>Aptosimum spinescens</i> .....	41
<i>Psilocaulon absimile</i> .....	710	<i>Sphalanthus tetragonus</i> .....	41
<i>Berkheyia annectens</i>	710	<i>Phaeoptilum spinosum</i> .....	41
<i>Osteospermum armatum</i> .....	360	<i>Erioccephalus ericooides</i> .....	37
<i>Tetragonia arboscula</i> .....	355	<i>Peliostomum leucorrhizum</i> ....	37
<i>Hermannia spinosa</i>	295	<i>Galenia africana</i> var. <i>africana</i> ....	32
<i>Nestlera humilis</i> ....	250	<i>Sarcocalon patersonii</i> .....	28
<i>Stipagrostis ciliata</i> ....	226	etc.	
<i>Brownanthus ciliatus</i> .....	198		
<i>Limeum aethiopicum</i> subsp. <i>aethiopicum</i> ....	134		

The total number of species recorded on this farm was 97, while in the Relative Abundance Table for the Driedoring Veld are 335 species.

It sometimes happens in the barer parts of this veld eastwards that a complete cover of *Tribulus* spp. will appear after rain.

(c) The Semi-succulent Southern Form of Arid Karoo

This occurs both on calcareous tufa and on stony soil, and is not so flat, nor so arid. It is dominated by *Salsola tuberculata* subsp. *tuberculata* (including a form which links this species with *S. rabeiana*), but less completely than in the Blomkooganna veld, this veld being more mixed. *Rhigozum trichotomum* does not occur, except along the northern margin. *Stipagrostis obtusa* and *S. ciliata* are still the commonest grasses, but the mesembs are more plentiful.

Typical species are:—

<i>Salsola tuberculata</i> subsp. <i>tuberculata</i>		<i>Drosanthemum framesii</i>	
<i>S. tuberculata</i> forma		<i>D. ambiguum</i>	
<i>S. glabrescens</i>		<i>D. lique</i>	
<i>Erioccephalus spinescens</i>		<i>Nestlera humilis</i>	
<i>E. ericooides</i>		<i>Osteospermum sinuatum</i>	
E. sp. = A. 12 634		<i>Delosperma subincanum</i>	
<i>Pentzia spinescens</i>		<i>Hymenocystis</i> sp.	
<i>Pteronia mucronata</i>		<i>Euryops multifidus</i> (E. part)	
<i>P. glauca</i>		<i>Euphorbia stolonifera</i>	
<i>P. inflexa</i>		<i>Aridaria noctiflora</i>	
<i>P. adenocarpa</i>		<i>Sphalanthus glanduliferus</i>	
<i>Felicia macrorhiza</i>		<i>Brownanthus ciliatus</i>	

*Ruschia ferox*  
*R. muricata*  
*Zygophyllum giffillanii*  
*Z. microphyllum*  
*Helichrysum lucilioides*  
*Polygala pungens*

*Hermannia spinosa*  
*H. cuneifolia*  
*Hippicium alienatum*  
*Trichodiadema*  
*pomeridianum*

and many more, with *Lycium* spp. more plentiful than in Form (a).

### 30 CENTRAL LOWER KAROO

(See Hutchinson, p. 439)

This veld type is related to the Arid Karoo and also occupies flat, stony country, but at a rather lower elevation of 700-1 050 m, and not quite so arid, receiving 150-250 mm of rain per annum, nowhere less than 150 mm. It is partly on calcareous tufa, partly on stony sandstone and shale and partly on silty flats and flood plains. The flora (Fig. 61) is much like that of the Arid Karoo, but shorter and denser, sometimes so dense as to be almost a complete cover; it shows a resemblance, too, to the short, dense Arid Karoo-invaded veld of silty flats in the Central Upper Karoo (p. 64). *Pentzia incana* (ankerkaro) and *Eberlanzia vulnerans* and other succulents play an important part, while the grasses, predominantly *Stipagrostis obtusa* and *S. ciliata*, are of Arid Karoo type. Along the Kariega River and its tributaries, the thornveld shows traces of having been densely grassy.

Typical species are:—

*Salsola tuberculata* subsp.  
*tuberculata*  
*Pentzia incana* (ankerkaro)  
*Eriocaphalus spinescens*  
*Eberlanzia vulnerans*  
*R. ferox*  
*Zygophyllum microphyllum*  
*Felicia filifolia*  
*Hermannia grandiflora*  
*H. cuneifolia*  
*Aptosimum steingroeveri*  
*Plinthus karrooicus*  
*Osteospermum microphyllum*  
*Felicia muricata*  
*Asparagus sp. (stiff glaucous)*  
*Nestlera humilis*  
*N. conferta* h  
*Justicia orchioidea* h

*Pteronia erythrochaeta*  
*Zygophyllum giffillanii* W  
*Sphalanthus tetragonus*  
*Drosanthemum framesii*  
*D. lique*  
*Phymaspernum pubescens*  
*Eriocaphalus ericooides*  
*Pteronia adenocarpa*  
*Limeum aethiopicum* subsp.  
*aethiopicum*  
*Ruschia uncinella* h  
*Euryops anthemoides* h  
*Zygophyllum incrassatum* h  
*Osteospermum spinescens* h  
*Asaemia axillaris* h  
*Lycium arenicolum* h  
*L. prunus-spinosa* h  
*L. spp. h*  
*Stipagrostis obtusa*  
*S. ciliata*

*Acacia karroo* W  
*Rhus lancea* W  
*Maytenus heterophylla* W  
*Diospyros pallens* W  
*Psoralea obtusifolia* W  
*Lebeckia spinescens*  
*Asparagus* sp.  
*Gazania rigens*  
*Radyera urens* h  
*Walafrida geniculata* h  
*Sutera atropurpurea* W  
*Malephora uitenhagensis* h  
*Delosperma multiflora* h  
*Stipagrostis anomala*

and many more, a very well mixed Karoo.

Low stony ridges (hills are non-existent) are transitional to Karroid Broken Veld with *Rhigozum obovatum* and a variety of other species belonging to that veld, including the grasses.

In this denser veld, annuals are less important than they are in the Arid Karoo; *Galenia* spp. are the commonest. It gives the impression of being better preserved than much of the Arid Karoo, and, as in that veld type, it is the darkly stony parts that are usually the worst in appearance, sometimes being virtually desertlike.

### 31 SUCCULENT KAROO

This is the veld of the low altitude, hot, arid areas with a winter or through the year rainfall. Rainfall ranges from about 50-200 mm per annum, and altitude from 0-600 m above sea-level. It is dominated by succulents, mainly mesembs, with few trees or large shrubs, except along the rivers, which are lined with *Acacia karroo*, *Tamarix usneoides*, *Rhus lancea* and a few other species. This dominance of the mesembs, however, is probably in part an artificial condition, just as it is in the Little Karoo.

There are three main forms of this veld: (a) The Namaqualand Coast Belt; (b) the Tanqua Karoo, with outliers in the valleys along the northern foot of the Swartberg; (c) The Steytlerville Karoo.

#### (a) The Succulent Karoo of the Namaqualand Coast Belt

(See Marloth I, Pl. 53B, II, 1, Pl. 34; II, 2, Fig. 96; White, Dyer and Sloan, Figs. 190, 276)

Here the Succulent Karoo occurs both on the sand of the coastal plain and the heavier, stony soil of



FIG. 61.—Central Lower Karoo (30) near Beaufort West in the Cape. Species noted: *Salsola tuberculata* subsp. *tuberculata*, *Zygophyllum flexuosum*, *Z. microphyllum*, *Z. microcarpum*, *Pentzia incana*, *Pteronia mucronata* and *Pegolettia retrofracta*.

the foothills. The mesembs are particularly dominant, ranging in habit from almost subterranean, stemless dwarfs (Fig. 62) to 2.5 m high shrubs. Rainfall ranges from 50-150 mm per annum, falling in winter, but aridity is reduced by sea-mists; altitude ranges from sea-level up to about 450 m. A curious feature of this region (and of the rest of the coast belt southwards) is the "heuweltjies", or mounds. They appear to have been formed by clumps of bush growing on termitaria; both bush and termitaria can still sometimes be found associated with them. Except in the south around Vanrhynsdorp, and in the north near Port Nolloth, this veld gives the impression of being in good condition.

Of the mesembs we can mention:—

<i>Ruschia caroli</i>	<i>Leipoldtia nelii</i>
<i>R. bolusiae</i>	<i>Mesembryanthemum annuum</i>
<i>R. viridifolia</i>	<i>M. sedentiflorum</i>
<i>R. bipapillata</i>	<i>M. stenandrum</i>
<i>R. tuberculosa</i>	<i>Malephora framesii</i>
<i>R. leucosperma</i>	<i>Rhinephyllum macradenium</i>
<i>R. utilis</i>	<i>Monilaria sp.</i>
<i>R. frutescens</i>	<i>Psilocaulon utile</i>
<i>R. robusta</i>	<i>P. rapaceum</i>
<i>R. comptonii</i>	<i>P. corallinum</i>
<i>R. fugitans</i>	<i>P. acutispernum</i>
<i>R. testacea</i>	<i>P. foliosum</i>
<i>R. conjuncta</i>	<i>Conophytum minutum</i>
<i>Lampranthus lunatus</i>	<i>C. calculus</i>
<i>R. rariflora</i>	<i>C. wettsteinii</i>
<i>R. mucronifera</i>	<i>Premia pallens</i>
<i>R. langebaanensis</i>	<i>Cephalophyllum curtophyllum</i>
<i>R. decurvans</i>	<i>C. spongiosum</i>
<i>R. hutchinsonii</i>	<i>C. pittenii</i>
<i>Drosanthemum eburneum</i>	<i>Argyroderma spp.</i>
<i>D. diversifolium</i>	<i>Cheiridopsis cuprea</i>
<i>D. subalbum</i>	<i>C. denticulata</i> var. <i>denticulata</i>
<i>Aridaria calycina</i>	<i>Dactylopius digitata</i>
<i>Spalmanthus framesii</i>	<i>Conicosia alba</i>
<i>S. trichotomus</i>	<i>Vanzylia annulata</i>
<i>S. delus</i>	<i>Apatesia sabulosa</i>
<i>S. watermeyeri</i>	
<i>Lampranthus uniflorus</i> var. <i>spathulatus</i>	
<i>L. watermeyeri</i>	

This list, however, is little better than a random sample of the wealth of mesembs in this veld. Among other succulents are:—

<i>Euphorbia mauritanica</i>	<i>C. lycopodioides</i>
<i>E. mundii</i>	<i>C. globosa</i>
<i>E. hamata</i>	<i>C. brevifolia</i> and many more
<i>E. loricata</i>	<i>Augea capensis</i>
<i>E. decussata</i>	<i>Senecio sp.</i>
<i>E. burmannii</i>	<i>Othonna floribunda</i>
<i>E. schoenlandii</i>	

<i>Cotyledon wallichii</i>
<i>C. ventricosa</i>
<i>C. decussata</i> and others
<i>Caralluma winkleri</i>
<i>Huernia spp.</i>
<i>Stapelia spp.</i>
<i>Crassula ovata</i>

<i>Adromischus mammillaris</i>
<i>A. sphenophyllus</i>
<i>Aloe krapohliana</i>
<i>A. arenicola</i> and others
<i>Sarcocaulon spinosum</i>
<i>S. l'heritierei</i>

and many more, whilst the non-succulents and semi-succulents include:—

<i>Salsola zeyheri</i>
<i>Galenia fruticosa</i> var. <i>prostrata</i>
<i>G. africana</i> var. <i>africana</i>
<i>Berkheya spinosa</i>
<i>B. fruticosa</i>
<i>Pteronia</i> sp. (Kambrobos)
<i>Salsola</i> sp.
<i>Asparagus capensis</i>
<i>A. stipulaceus</i>
<i>Zygophyllum retrofractum</i>
<i>Z. lichensteinianum</i>
<i>Z. stapfii</i>
<i>Z. spinosum</i>
<i>Osteospermum sinuatum</i>
<i>Hirpicium alienatum</i>
<i>Chrysocoma longifolia</i>
<i>Hermannia multiflora</i>
<i>Pelargonium fulgidum</i>

and a few grasses:—

<i>Ehrharta calycina</i>
<i>Lasiochloa longifolia</i>
<i>Stipa tortilis</i>
<i>Pentaschistis</i> spp.
<i>P. sp.</i> (= <i>A. 14796</i> )

<i>Schismus barbatus</i>
<i>Stipagrostis obtusa</i> (inland parts)
<i>Chaetobromus schraderi</i>
<i>Urochlaena pusilla</i>

The white annual, *Stipa tortilis*, is sometimes abundant, especially on the "heuweltjies", while a red-flowered, annual form of *Ehrharta calycina* is sometimes abundant enough to colour the veld in parts; it was formerly mown for hay.

A large number of annuals and bulbous plants could be named, but a discussion of this part of the flora will be postponed until after it has been studied in a good flowering season. This depends on a good succession of winter and spring rains.

#### (b) The Tanqua Karoo

[See Marloth I, Pl. 46, 53B; III, 1, Fig. 13; Hutchinson, facing p. 193 (Prince Albert)]

This occupies the valley of the Tanqua and Doorn Rivers, flat country at elevations ranging from 200-750 m, mostly 300-450 m above the sea (Fig. 63). It is enclosed by mountains which cut off

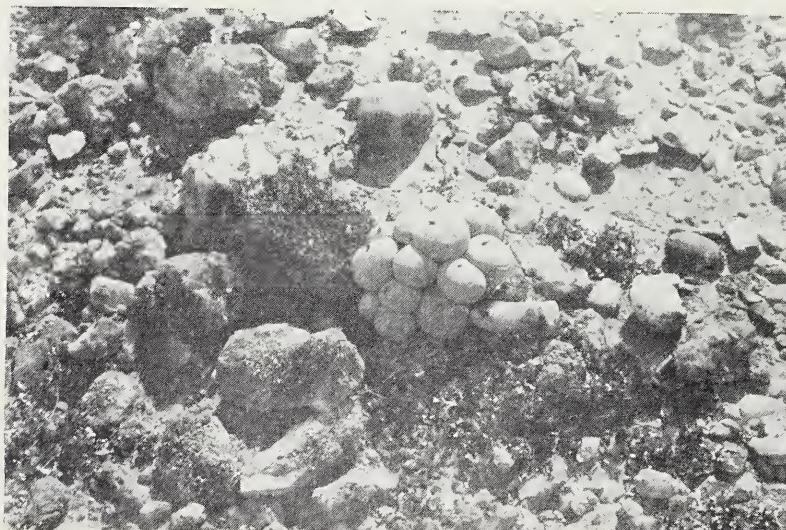


FIG. 62.—Namaqualand Coast-belt (31a) Variation of Succulent Karoo. Present: the succulent *Conophytum calculus* and lichens.

FIG. 63.—Tanqua Karoo (31b) south of Commando Drift in the western Cape. Species noted: *Pteronia intermedia*, *Sarcocaulon spinosum*, *Arctotis fastuosa*, *Stipagrostis obtusa*, *S. ciliata* and *Euryops annuus* in distance.



the rain to the extent that the whole valley receives less than 150 mm per annum, falling mostly in winter. It is terribly tramped out, and eroded down to the bare shale, the lower part of it in the angle between the Tanqua and Doorn Rivers, being almost total desert. The better parts are a short succulent karooy, many of the mesembs being of the stemless type; non-succulents also occur and so does *Stipagrostis obtusa*, even becoming abundant after good rains. Annuals and geophytes are numerous as regards species, but rarely seen.

In the better parts, the following will be found, and many more, especially amongst the mesembryanthemids, annuals and geophytes:—

Ruscus aculeatus	Rhus lancea W
R. sp. = 14461	Sceletium spp.
R. leucosperma	Tamarix usneoides W
R. aculeata	Salsola aphylla W
R. crassa	Suaeda fruticosa W
Sphalanthus tetragonus	Nicotiana glauca W
S. blandus	Pteronia glauca J
S. glanduliferus	Erioccephalus spinescens
Aridaria noctiflora	Osteospermum sinuatum
Rhinephyllum	Arthrosolen sp. = A. 14458
macradenium	Euphorbia decussata
R. luteum	E. mauritanica
Pleiospilos prismaticus	E. mundii
Brownanthus ciliatus	Hoodia gordonii
Cephalophyllum	Tetragonia sp.
curtiphyllum	Sarcocaulon spinosum
Echinus geminatus	S. patersonii
Lampranthus uniflorus var.	Crassula cornuta
spathulatus	C. spp.
Drosanthemum lique	Adromischus spp.
D. eburneum	Caralluma inversa
Sphalanthus rhodandrus	Cotyledon wallichii I
Hereroa fimbriata	C. reticulata
H. latipetala	Augea capensis
H. stanleyi	Lycium arenicolum
H. odorata	Asparagus capensis
Psilocaulon utile	A. sp.
Mesembryanthemum	Homeria speciosa
chrysanthemum	Tritonia sp. cf. T. flava =
Galenia fruticosa var.	A. 14456
prostrata	Cyphia comptonii
G. africana var. africana	Europs annuus
Salsola zeyheri	Amellus strigosus
S. sp. (= A. 14455)	Felicia bergerana
Monechma pseudopatulum	Hebenstretia integrifolia
Zygophyllum retrofractum	H. parviflora
Deverra aphylla W	Lotononis leptoloba
Acacia karroo W	

As in the Steytlerville Karoo, the creeping species of mesembs are sometimes abundant on silty flats.

Grasses are scarce in this veld; they include:—

*Stipagrostis obtusa*      *Eragrostis spinosa*  
*S. ciliata*                  *Enneapogon desvauxii*  
*S. namaquensis*

(c) The Steytlerville Karoo

(See White, Dyer and Sloane, Fig. 677)

This, too, is flat country but is mostly silty rather than stony, so that the creeping mesembs are here important, e.g. *Malephora uitenhagensis* and *Nycteranthus splendens*. Typical species are:—

Pentzia incana (ankerkaroo)	Psilocaulon spp.
Eberlanzia vulnerans	Mesembryanthemum spp.
Salsola tuberculata forma	(annuals)
Zygophyllum microphyllum	Glottiphyllum
Felicia muricata	semicylindricum
Drosanthemum fourcadei	Kochia pubescens
Eriocephalus ericooides	Euryops anthemoides
Malephora luteola	Asparagus sp. (= A. 11908)
M. uitenhagensis	Galenia sp. (= A. 13224)
Sphalanthus splendidus	G. sarcophylla
Delosperma multiflora	Augea capensis
Lycium oxycladum	Chrysocoma tenuifolia
Euphorbia inermis	Aloe variegata (rare)
Blackiella inflata	A. longistyla (rare)

and many more, in good samples a dense veld. If this is False Succulent Karoo, in its original condition it would have been Central Lower Karoo. Where it is tramped out, permitting wind erosion to occur, the creeping mesembs tend to build up low hummocks. Grasses are scattered all through, e.g.:—

Aristida diffusa var. burkei	Digitaria argyrograpta
Stipagrostis obtusa	Eragrostis lehmanniana
S. ciliata	E. curvula
Sporobolus fimbriatus	E. obtusa
S. ludwigii	Tragus koelerioides

*Aristida diffusa* var. *burkei* occurs especially on low stony rises, while on the flats, *Tragus koele-rioides* with the annuals, *Aristida adscensionis* and *Chloris virgata* are sometimes abundant. Where the Grahamstown-Port Elizabeth Road crosses the Sundays River valley, outliers of this veld will be found, replacing the stunted scrub of the saline flats.

### **32 ORANGE RIVER BROKEN VELD**

(a) The typical form of this veld type occupies steep, rocky mountains, on which grow *Aloe dichotoma* and *Euphorbia avasmontana*. It occurs

between Prieska and Kakamas, at the latter place beginning a gradual transition to Namaqualand Broken Veld.

(b) It occurs also very extensively on gravelly and stony plains, where it is predominantly *Rhigozum trichotomum* Veld.

(c) Above Prieska it occurs on rolling stony country in the valley and is predominantly *Acacia mellifera* subsp. *dentinens* Veld. It is this third form which is spreading up the valleys of the Vaal-Hartz and Orange Rivers as False Orange River Broken Veld. Below Prieska, all these variations will occur together, according to the topography.

#### (a) Typical Orange River Broken Veld

[See Hutchinson, facing pp. 64 (Koegas), 192 and 193 (Prieska), 320 (Koegas); Reynolds, Pl. 74; White, Dyer and Sloane, Fig. 918]

The presence of *Aloe dichotoma* with *Euphorbia avasmontana* makes this veld type quite unmistakable (Fig. 64). Just as the valley bushveld and related types are adaptations of the eastern coastal branch of the tropical flora to arid conditions, so the Orange River Broken Veld is an adaptation of the central branch of the tropical flora, while the Namaqualand Broken Veld is not only an adaptation of the west coastal and central branches, but also of certain elements of the eastern branch which have worked their way right along the coast. The Orange River Broken Veld also has a few elements of the east coastal flora and of the west coastal flora, which have come up the Orange River valley or else across the eastern part of the upper plateau where now is False Karo.

The typical Orange River Broken Veld occurs on a variety of rocks, e.g. banded ironstone, dolomite, quartzite and granite. Altitude ranges from 750-1 350 m above sea-level and rainfall from about 150-350 mm per annum. Owing to its proximity to the permanent water of the Orange River, it is, as a rule, badly tramped out.

Typical trees and shrubs include:—

- Aloe dichotoma*
- Euphorbia avasmontana*
- Sarcostemma viminale*  
forma
- Acacia mellifera* subsp.  
*dentinens*
- A. karroo* W

- Phaeoptilum spinosum*
- Ziziphus mucronata*
- Rhigozum trichotomum*
- R. obovatum*
- Lycium austrinum*
- Ehretia rigida*
- Boscia albitrunca*

<i>A. erioloba</i>	<i>Cadaba aphylla</i>
<i>Rhus lancea</i> W	<i>Putterlickia pyracantha</i>
<i>R. viminalis</i> W	<i>Nymania capensis</i>
<i>R. undulata</i> var. <i>tricrenata</i>	<i>Ficus ingens</i>
<i>R. dregeana</i>	<i>Olea africana</i>
<i>Salix capensis</i> W	<i>Grewia flava</i>
<i>Tarchonanthus minor</i>	

with *Tamarix usneoides* coming up the Orange River nearly as far as Koegas.

The smaller plants include:—

<i>Barleria tigida</i>	<i>Rhynchosia totta</i>
<i>Monechma spartoides</i>	<i>Asparagus stipulaceus</i>
<i>Aizoon burchellii</i>	<i>Antizoma capensis</i>
<i>Corbicinia decumbens</i>	<i>Rogeria longiflora</i>
<i>Sericocoma avolans</i>	<i>Argemone subfusciformis</i> w
<i>Pachypodium succulentum</i>	<i>Kissenia capensis</i>
<i>Asclepias burchellii</i>	<i>Codon royenii</i>
<i>Chrysocoma tenuifolia</i>	<i>Forskohlea candida</i>
<i>Dicoma capensis</i>	<i>Trichodesma africanum</i>
<i>Eriocaulus pubescens</i>	<i>Dyerophytum africanum</i>
<i>Felicia muricata</i>	<i>Limeum aethiopicum</i> subsp. <i>aethiopicum</i>
<i>Euryops multifidus</i>	<i>Talinum caffrum</i>
<i>Garuleum schinzii</i>	<i>Thesium lineatum</i>
<i>Geigeria ornativa</i>	<i>Aptosimum spinescens</i>
<i>Helichrysum lucilioides</i>	<i>Sutera argentea</i>
<i>Senecio longiflorus</i>	<i>Aloe hereroensis</i>
<i>Pegolettia retrofracta</i>	<i>Hermannia abrotanoides</i>
<i>Pentzia sphaerocephala</i>	<i>H. vestita</i>
<i>P. argentea</i>	<i>H. helianthemum</i>
<i>Pteronia glauca</i>	<i>Chascanum pinnatifidum</i>
<i>P. unguiculata</i>	<i>Lantana rugosa</i>
<i>Chascanum garipense</i>	<i>Tribulus terrestris</i>
<i>Osteospermum microphyllum</i>	<i>T. zeyheri</i>
<i>Euclea crispa</i> var. <i>ovata</i>	<i>Berkheya spinosissima</i> subsp. <i>namaensis</i>
<i>E. undulata</i>	<i>Cleome diandra</i>
<i>Phyllanthus maderaspatensis</i>	<i>Salvia garipensis</i>
<i>Lasiocorys capensis</i>	<i>Euphorbia glanduligera</i>
<i>Stachys burchelliana</i>	<i>E. spinea</i>
<i>Indigofera heterotricha</i>	<i>Justicia thymifolia</i>
<i>I. sessilifolia</i>	<i>Zygophyllum suffruticosum</i>
<i>Adenium oleifolium</i>	

and many more, a rich flora, though a sparse vegetation. This list was extracted mostly from an uncompleted Relative Abundance Table which was made 14 years ago for all the veld types of Griqualand West, in which the families were arranged alphabetically and the genera and species likewise. In the other lists the species are arranged very roughly in order of importance.

In the typical Orange River Broken Veld grasses are important and include:—

<i>Aristida diffusa</i> var. <i>burkei</i>	<i>E. lemanniana</i>
<i>Digitaria smutsii</i>	<i>Fingerhuthia africana</i>
<i>Cenchrus ciliaris</i>	<i>Eustachys mutica</i>



FIG. 64.—Typical Form (32a) of Orange River Broken Veld near Kakamas in the north-western Cape. Species noted: *Aloe dichotoma*, *Euphorbia avasmontana*, *Kissenia capensis* and *Monechma atherstonii*.

<i>Cymbopogon plurinodis</i>	<i>Panicum staphianum</i>
<i>Enneapogon scaber</i>	<i>Sporobolus fimbriatus</i>
<i>E. scoparius</i>	<i>Oropetium capense</i>
<i>Eragrostis curvula</i>	<i>Tricholaena capensis</i>
<i>E. nindensis</i>	

In the Kakamas neighbourhood, a number of species of northern, southern and western affinity occur (although *Aloe dichotoma* and *Euphorbia avasmontana* are still present), e.g. *Leucosphaera bainesii*, *Euphorbia dregeana*, *Microloma incanum*, *Thamnosma africanum*, *Boscia foetida*, subsp. *foetida*, *Setaria appendiculata*, *Triraphis ramosissima*, *Commiphora graciliflora* (A. 14246), *Montinia caryophyllacea*, *Anthreothamnus pearsonii*, *Curroria decidua*, *Berkheya canescens*, *Aridaria* sp. = A. 14381, *Helichrysum benguellense*, *Geigeria vigintiquamea*, *Pappea capensis*, *Schotia afra* var. *afra*, *Ruschia kakamasensis*, *Sphalmanthus tetragonus*, *Hereroa bergeriana* and *Anomalesia saccata*.

(b) **The Rhigozum trichotomum Veld of the Plains**  
[See Hutchinson, facing p. 192 (Koegas), White, Dyer and Sloane, Fig. 181]

This is a simpler veld; the dominant shrub is *Rhigozum trichotomum*, sometimes growing densely, sometimes scattered, but usually tending to spread into clumps by means of its stolons. In sandy valleys it grows up to 2 m tall, but usually it is 1 m tall. At the upper margin of the Orange River Broken Veld, where it merges into the Arid Karoo, this may be the only shrub, but, as a rule, it is accompanied by a few other shrubs and dwarf trees, especially *Boscia albitrunca*, *B. foetida* subsp. *foetida*, *Phaeoptilum spinosum*, *Acacia mellifera* subsp. *detinens* and *Parkinsonia africana*. In this veld there are more karoo bushes than in the typical form; in fact, all of those of the Arid Karoo, but in different proportions—thus *Salsola tuberculata* subsp. *tuberculata* is scarce. There are also some additions, e.g. *Zygophyllum dregeanum*, *Z. suffruticosum*, *Aloe claviflora*, *Aptosimum marlothii* and *Euphorbia gariepina*; while the grasses are dominantly *Stipagrostis obtusa* and *S. ciliata*, in addition *Cenchrus ciliaris*, *Eragrostis lehmanniana* and the annuals *Eragrostis porosa*, *E. annulata*, *E. echinochloidea*, *E. brizantha*, *Schmidia kalihariensis*, *Triraphis fleckii* and *Aristida congesta* subsp. *barbicollis* are important. A grass which was probably formerly an important grazing species is *Panicum lanipes*, now rare; others are *Asthenatherum glaucum* and *Aristida engleri*, even rarer. *Aloe claviflora* is sometimes

common on sandy calcareous tufa. In extreme cases of overgrazing the last survivors of this veld may be *Rhigozum* and *Augea capensis*.

(c) **The Acacia mellifera subsp. *detinens* Veld**

(See Reynolds, Pl. 34)

Although not confined to the part of the Orange River valley above Prieska, this variation of the Orange River Broken Veld is there best developed and most extensive. It is associated with calcareous tufa often of great depth, littered with stones; in fact, patches of it which occur in the valleys below Prieska, amongst the volcanic hills, are so stony as to be known locally as the Swartklipveld. This veld is a fairly dense growth of *Acacia mellifera* subsp. *detinens*, 2 m high, with a great variety of karoo bushes and grasses (Fig. 65).

Other trees and shrubs are:—

<i>Rhus undulata</i> var. tricrenata	<i>Phaeoptilum spinosum</i>
<i>Rhigozum obovatum</i>	<i>Ziziphus mucronata</i>
<i>R. trichotomum</i>	<i>Lycium</i> spp.
<i>Boscia albitrunca</i>	<i>Grewia flava</i>
<i>Cadaba aphylla</i>	<i>Olea africana</i> (kloofs)

The smaller plants include:—

<i>Acanthopsis hoffmannseggiana</i>	<i>Pentzia globosa</i>
<i>Barleria lichtensteiniana</i>	<i>P. lanata</i>
<i>B. rigida</i>	<i>Pteronia mucronata</i>
<i>Monechma desertorum</i>	<i>P. glauca</i>
<i>Aizoon burchellii</i>	<i>P. unguiculata</i>
<i>A. schellenbergii</i>	<i>Lasiocorys capensis</i>
<i>Plinthus karrooicus</i>	<i>Ptychosolium biflorum</i>
<i>Trianthema triquetra</i> subsp. parvifolia	<i>Asparagus stipulaceus</i>
<i>Cyphocarapa angustifolia</i>	<i>Ornithoglossum viride</i>
<i>Hoodia gordonii</i>	<i>Limeum aethiopicum</i> subsp. aethiopicum
<i>Stapelia flavopurpurea</i>	<i>Lophiocarpus polystachyus</i>
<i>Tavaresia barklyi</i>	<i>Polygala asbestina</i>
<i>Cleome diandra</i>	<i>Thesium lineatum</i>
<i>Eriocephalus ericoides</i>	<i>Aptosimum spinescens</i>
<i>E. pubescens</i>	<i>A. albomarginatum</i>
<i>E. spinescens</i>	<i>Sutera pinnatifida</i>
<i>Felicia muricata</i>	<i>Hermannia abrotanoides</i>
<i>Garuleum schinzii</i>	<i>H. spinosa</i>
<i>Geigeria ornativa</i>	<i>Melhania rehmannii</i>
<i>G. pectidea</i>	<i>Fagonia minutistipula</i>
<i>Senecio longiflorus</i>	<i>Zygophyllum microphyllum</i>
<i>Nestlera humilis</i>	<i>Tribulus terrestris</i>
<i>Pegolettia retrofracta</i>	<i>T. zeyheri</i>
<i>Pentzia argentea</i>	<i>T. cristatus</i>

with the following grasses:—

<i>Aristida adscensionis</i>	<i>Enneapogon desvauxii</i>
<i>Digitaria</i> sp.	<i>E. scaber</i>
<i>Cenchrus ciliaris</i>	<i>Eragrostis nindensis</i>
<i>Cypholepis yemenica</i>	<i>Sporobolus fimbriatus</i>
<i>Fingerhuthia africana</i>	<i>Oropetium capense</i>



FIG. 65.—*Acacia mellifera* subsp. *detinens* Veld (32c) on the Kaap Plateau Escarpment at Naras, Cape. Species noted: *Acacia mellifera* subsp. *detinens*, *Ficus cordata* and *Aristida diffusa*.

i.e., a fairly complete Karoo flora, but lacking the mesembs: a few occur, but are rare. Grasses were certainly formerly more plentiful, and it is potentially good veld.

### 33 NAMAQUALAND BROKEN VELD

This veld type has three variations: (a) the typical form of the dome shaped granite hills and the rarer quartzite hills; (b) the *Rhigozum trichotomum* Veld of the gravelly plains in the Orange River valley; (c) the False Desert grassveld which results from the grazing out of the karoo bushes in the more open parts of (b).

#### (a) The Typical Form of the Namaqualand Broken Veld

(See Hutchinson, pp. 157, 159, 162, 163, 173; Reynolds, Pl. 73, Figs. 551, 552, Pl. 75, Figs. 556, 557, 446; King, Fig. 129)

This is characterized by *Aloe dichotoma* and is mainly distinguished from the Orange River Broken Veld by the absence of *Euphorbia avasmontana* and by the importance of succulents, both mesembs and others (Fig. 66). The rain falls in winter, amounting to about 150-300 mm per annum, while altitudes range from 300-1 350 m above the sea. It is a taller and denser veld than the Orange River Broken Veld and has resisted overgrazing better, because of the inedible nature of so many of the succulents. A good deal of soil erosion nevertheless occurs. The country is very broken and steep, and, as in the Spekboomveld, we find an aspect difference—on southern aspects, especially at higher altitudes, the vegetation is less succulent and taller, forming a scrub. The granite “domes” that make Namaqualand so picturesque, also encourage a surprising amount of shrubiness by increasing the effective rainfall on the slopes below them. The northern part of this veld, in the Richtersveld, has not been studied during this survey; here occur *Aloe pillansii* and *Pachypodium namaquanum* (Fig. 67).

The principal trees and shrubs are:—

<i>Aloe dichotoma</i>	<i>Ficus ingens</i>
<i>A. pillansii</i> (Richtersveld)	<i>F. guerichiana</i>
<i>Pachypodium namaquanum</i> (Richtersveld)	<i>Dodonaea viscosa</i> var. <i>angustifolia</i>
<i>Rhus undulata</i> var. <i>undulata</i>	<i>Maytenus oleoides</i>

*Putterlickia pyracantha*

<i>R. horrida</i>	<i>Euclea undulata</i>
<i>Ozoroa concolor</i>	<i>E. tomentosa</i>
<i>Acacia karroo</i> W	<i>Erythrophysa alata</i>
<i>A. erioloba</i> W	<i>Diospyros</i> sp. = A. 14240
<i>Tamarix usneoides</i> W	<i>Pappea capensis</i>
<i>Boscia albitrunca</i> W	<i>Aloe khamiesensis</i>
<i>Euphorbia dregeana</i>	<i>Ruschia frutescens</i>
<i>Othonna arbuscula</i>	<i>R. utilis</i>

The smaller plants include:—

<i>Galenia africana</i> var. <i>africana</i>	<i>Didelta spinosa</i>
<i>G. fruticosa</i> var. <i>prostrata</i>	<i>Teedia lucida</i>
<i>Euphorbia mauritanica</i>	<i>Eriocaphalus ericoides</i>
<i>E. burmannii</i>	<i>E. africanus</i>
<i>E. mundii</i>	<i>Othonna floribunda</i>
<i>Pteronia incana</i>	<i>Senecio corymbiferus</i>
<i>P. sp. (kambrobos)</i>	<i>S. cotyledonis</i>
<i>Zygophyllum morgsana</i>	<i>S. junceus</i>
<i>Antizoma miersiana</i>	<i>Ceraria namaquensis</i>
<i>Ruschia caroli</i>	<i>Pelargonium squarrosum</i>
<i>R. viridifolia</i>	<i>P. crithmifolium</i>
<i>R. ferox</i>	<i>Cotyledon wallichii</i>
<i>R. robusta</i> and many more	<i>C. paniculata</i>
<i>Crassula brevifolia</i>	<i>Berkheyia spinosa</i>
<i>Octopoma</i> spp.	<i>Thesium lineatum</i>
<i>Dyerophytum africanum</i>	<i>Stachys multiflora</i>
<i>Hermbstaedtia glauca</i>	<i>Euryops tenuissimus</i>
<i>Tetragonia</i> spp.	<i>Othonna</i> sp. (A. 15094)
<i>Osteospermum oppositifolium</i>	<i>O. abrotanifolia</i>
<i>Sisymbrite sparteae</i> W	<i>O. graveolens</i>
<i>Montinia caryophyllacea</i>	<i>Lycium</i> spp.
<i>Lebeckia sericea</i>	<i>Sarcocaulon l'heritierei</i>
	<i>Caralluma winkleri</i>
	<i>Chrysocoma coma-aurea</i>

with a great variety of smaller mesembs, *Crassula* spp., *Adromischus* spp., *Pelargonium* spp., *Stapeliads* and *Cotyledon* spp., as well as annuals and bulbous plants.

The less succulent scrub of southern aspects is dominated by *Pteronia leptospermoidea*, *P. undulata*, *P. divaricata*, *Salvia dentata*, *Rhus horrida*, *Eriocaphalus africanus* and *Indigofera pungens*. This scrub merges easily into the Western Mountain Karoo which occurs generally on what flattish parts there are on the higher ridges between the valleys, where there is some depth of gravelly soil.

Grasses are sparse, though many species occur, many of southern type, e.g.:—

<i>Ehrharta calycina</i>	<i>Enneapogon scaber</i>
<i>Merxmuellera stricta</i>	<i>Bromus</i> spp. (annuals)
<i>Pentaschistis</i> spp. (annual)	<i>Triisetum pumilum</i> W
<i>Pentaschistis brachyathera</i>	<i>Schismus barbatus</i>
<i>Chaetobromus dregeanus</i>	<i>Cymbopogon plurinodis</i>
<i>Fingerhuthia africana</i>	<i>Aristida engleri</i>



FIG. 66.—Typical Form of Namaqualand Broken Veld (33a) near Pella in the north-western Cape. Present: *Sarcocaulon yiminale* and mesembs.

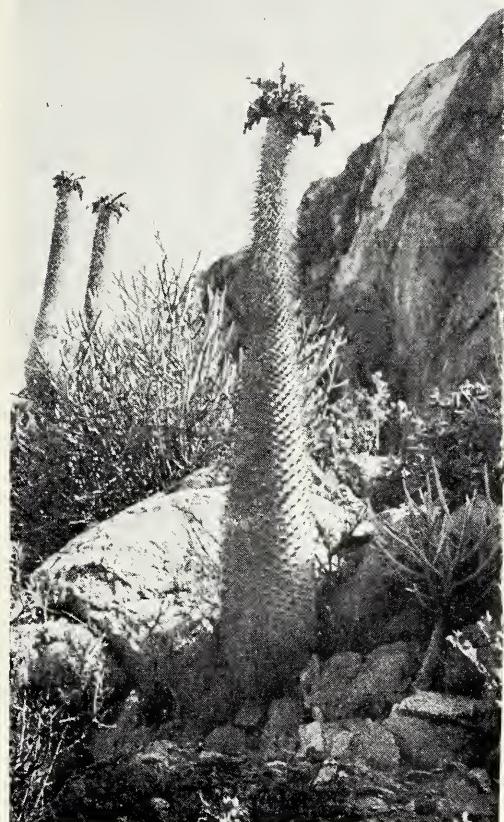


FIG. 67.—*Pachypodium namaquanum* and *Euphorbia gummiflua* occurring in the Typical Form (33c) of Namaqualand Broken Veld in the Richtersveld.

The outliers of this veld type occurring on the scattered hills and mountains up the Orange River valley, have a few other species:—

<i>Monechma mollissimum</i>	<i>Bauhinia garipensis</i>
<i>M. fimbriatum</i>	<i>Euclea pseudoebenus</i> W
<i>Curroria decidua</i>	<i>Maerua gilgii</i> TW
<i>Commiphora graciliflora</i>	<i>Phaeoptilum spinosum</i>
<i>Boscia foetida</i> subsp. <i>foetida</i>	<i>Rhigozum trichotomum</i>
<i>Zygophyllum meyeri</i>	<i>Diospyros glandulifera</i>
<i>Rhus populifolia</i>	<i>Nymania capensis</i>
	<i>Schotia afra</i> var. <i>afra</i>
	<i>Maytenus linearis</i>

while the grasses are the same as in the lower part of the Orange River Broken Veld.

Between Pofadder and the Orange River, in the Kaboop valley, occur some curious and extensive "forests" of *Aloe dichotoma*, on granite gravel slopes below the hills, an unusual habitat for this species. In 1948 it was noticeable that the trees further down the slopes were mostly dead, whereas those further up were still flourishing, suggesting perhaps that, for the first time in the long life of these plants, there was insufficient water draining from the hills, over the surface of the granite under the gravel, to reach the lower part of the "forest".

#### (b) The Rhigozum trichotomum Veld

(See Hutchinson, p. 175)

This is very similar to the corresponding variation of the Orange River Broken Veld, but has some species which are rare, or not represented at all in

that veld, e.g. *Sisyndite sparteo*, *Asclepias bucheniana*, *Hermannia stricta*, *Leucophrys mesocoma*, *Antizoma* sp. (A. 14260), *Sutera maxii* and *Microlobia incanum*.

#### (c) The False Desert Grassveld

In its extreme form, this is a pure grassveld consisting of *Stipagrostis brevifolia*, *S. obtusa*, and *S. ciliata*, with such annuals as *Tribulus terrestris*, *T. zeyheri* and *Schmidia kalihariensis*, but usually there are a few bushes and dead remains of bushes to show what its real nature is (Fig. 68). Towards Goodhouse, for kilometres, patches of *Stipagrostis brevifolia* are practically all the permanent vegetation. The other two *Aristida* spp. are at a disadvantage in remaining edible when dry and dormant, lacking the woody twigginess of *S. brevifolia*. Indeed, it is said that *S. ciliata* does not really become palatable until its tufts have been dormant for a year or so and become grey and matted; the apt description "blou-dak" is applied to it in this condition.

### 34 STRANVELD

(See Taljaard, Photo 1; Reynolds, Pl. 48; Hutchinson, p. 31)

This is the vegetation of the lower parts of the sandy western coastal plains, receiving 50-300 mm of rain per annum mainly in winter. It has two variations: (a) A dense, dwarf, semi-succulent scrub, related to the Gouritz River Scrub; (b) the Strandveld proper, an open, semi-succulent scrub of Fynbos form and intermediate between the Coastal Fynbos and the Succulent Karoo. Bush clumps occur on the hillocks or "heuweltjies".

#### (a) Dense Strandveld Scrub

One good sample of this scrub has been studied at Yzerfontein. Here it is about 1 m high and very dense, a lilliputian forest; but it is generally shorter and more open. Outliers and traces of it occur along the south coast as far as the Sundays River mouth.

The principal species include:—

<i>Rhus glauca</i>	<i>Putterlickia pyracantha</i>
<i>Euclea racemosa</i>	<i>Ruschia macowanii</i>
<i>Zygophyllum morgsana</i>	<i>R. decurvans</i>
<i>Euphorbia burmannii</i>	<i>R. bipinnatifida</i>
<i>E. mauritanica</i>	<i>R. utilis</i>
<i>E. marlothiana</i>	<i>Solanum guineense</i>
<i>Senecio</i> sp. (A. 14513)	<i>Lycium</i> sp.
<i>Pteronia divaricata</i>	<i>Salvia africana-lutea</i>
<i>P. onobromoides</i>	<i>Cynanchum ellipticum</i>
<i>Polygala myrtifolia</i>	<i>Lebeckia spinescens forma</i>
<i>Pterocelastrus tricuspidatus</i>	<i>Chrysanthemoides moniliformis</i>
<i>Cotyledon paniculata</i>	<i>Tetragonia spicata</i>
<i>Limonium perigrinum</i>	<i>Agropyron distichum</i>
<i>Asparagus asparagoides</i>	<i>Eragrostis cyperoides</i>
<i>A. fasciculatus</i>	<i>Pteronia ovalifolia</i>
<i>A. falcatus</i>	<i>Euclea tomentosa</i>
<i>A. retrofractus</i>	<i>Thesium spinosum</i>
<i>Pelargonium fulgidum</i>	<i>Rhus laevigata</i>
<i>P. gibbosum</i>	
<i>Aloe mitriformis</i>	

A patch of this scrub may be seen on the west coast of the Cape Peninsula between Witsand and Scarborough, but less xerophytic and transitional to Dune Forest. The dominants here are *Sideroxylon inerme*, *Maurocenia frangularia*, *Myrsite africana*, *Maytenus heterophylla*, *Tarchonanthus camphoratus*, var. *camphoratus*, *Rhus glauca*, *Liuociera foveolata* and *Maytenus oleoides*, very dense and stunted, and matted together with profusion of *Cynanchum ellipticum*, *Dipogon lignosus*, *Tetragonia spicata*, *Cussonia thyrsiflora*, *Pelargonium gibbosum*, *Asparagus falcatus* and *Solanum guineense*, with *Rushchia* sp. plentiful at the lower margin.

FIG. 68.—False Desert Grassveld (33c) between Pofadder and Springbok in the north-western Cape. Present: *Stipagrostis brevifolia*, *Schmidia kalahariensis* and *Galenia sarcophylla*.



#### (b) Strandveld Proper

This is more open scrub (Figs. 69 and 70), rather clumpy, including the following species:—

*Salvia nivea*  
*S. africana-lutea*  
*Zygophyllum morgsana*  
*Ruschia utilis*  
*R. langebaanensis* and  
others  
*Lebeckia spinescens* forma  
*Pteronia divaricata*  
*Lycium afrum*  
*Euphorbia burmannii*

*Justicia orchoides*  
*Galenia africana* var.  
*africana*  
*Wiborgia armata*  
*W. obcordata*  
*Aspalathus suffruticosa*  
*Hermannia trifurca*  
*Nylandtia spinosa*  
*Eriocephalus racemosus*  
*Willdenowia striata*

with species of the dense scrub in the bush clumps and on rocky outcrops, and a variety of smaller bushes, annuals and grasses in the spaces between the larger shrubs, e.g.:—

*Grielum tenuifolium*  
*Helichrysum tricostatum*  
*Chaetobromus dregeanus*  
*Ehrhartia villosa*  
*E. calycina*  
*Galenia africana* var.  
*africana*

*Hermannia incana*  
*H. linifolia*  
*Zygophyllum spinosum*  
*Manochlamys albicans*  
*Manulea laxa*  
*Thesium spinosum*  
Mesembs

and many more.

The grasses become plentiful if given a chance, as in the Nortier Reserve, near Lambers Bay, or at Britannia Bay. The dunes at the latter place are particularly grassy, having also *Schismus barbatus*.

*Willdenowia striata* becomes plentiful near the upper margin of this veld, providing an easy transition to Arid Fynbos; while towards the lower margin an increase in the proportion of mesembs causes it to pass easily into Succulent Karoo.

#### IVA FALSE KAROO TYPES

There is no point in burdening this preliminary paper with lists of the species occurring in these veld types, because they would merely be repetitions of the lists given in describing the corresponding genuine veld types. They will be fully described later, when the Relative Abundance Tables have been worked out, and quantitative differences established.

#### 35 FALSE ARID KAROO

As has been pointed out (p. 63) the whole of the Central Upper Karoo is more or less invaded by elements of the Arid Karoo; but in the part of the original Central Upper Karoo separated as False Arid Karoo, this invasion is so complete that the veld is little different from Arid Karoo, except that it retains many of its own species. The False Arid Karoo lies mainly below 1 200 m. Much of it has suffered through sheet erosion, but there are some better preserved parts, e.g. between Hopetown



FIG. 69.—Strandveld Proper (34b) near Port Nolloth in the north-western Cape. Present: restiads and mesembs.

FIG. 70.—*Zygophyllum morgiana* in Strandveld Proper (34b) north of Van Rhynsdorp in the western Cape.



and Prieska, whose grassiness gives some idea of what the natural condition of the Central Upper Karoo was. The dominant grass, however, is now *Stipagrostis obtusa*, instead of *Eragrostis lehmanniana* and its associates (Fig. 71).

The plants which are considered to belong to the Arid Karoo, and to be, therefore, invaders in this region, are the following:

<i>Pentzia spinescens</i>	<i>Salsola tuberculata</i> subsp. tuberculata
<i>Stipagrostis obtusa</i>	<i>Pteronia mucronata</i>
<i>S. ciliata</i>	<i>Monechma desertorum</i>
<i>Peliostomum leucorrhizum</i>	<i>Phaeoptilum spinosum</i>
<i>Aptosimum spinescens</i>	<i>Eriocephalus spinescens</i>
<i>A. steingroeveri</i>	<i>Monechma incanum</i>
<i>Ruschia ferox</i>	<i>Aizoon canariense</i> and other annuals
<i>Zygophyllum microphyllum</i>	
<i>Hermannia spinosa</i>	

It must be remembered that many of these species always have existed in the Central Upper Karoo, but in a subordinate position; so that the word "invade" may partly mean "thicken-up".

The power these arid Karoo plants have of resisting conditions which hold the Central Upper Karoo species in a dormant state, has been well demonstrated this spring in the Hofmeyr-Middelburg-Naauwpoort-Hanover area, i.e. not merely in the relatively dry Central Upper Karoo region, but

actually in the wetter False Karoo region. This season (1951), this region has had two showers since May: about 13 mm in September (promptly dried up by hot, dry winds), and 50 mm in October, an effective rain, which caused growth to start and the veld to green up. Instead of more rain, however, we have had almost continuous strong winds from the north-west and west, hot and dry; coming not in August, the traditional month for them, but in the hot months of October, November and even December. In consequence, the grasses and karoo bushes did not come into flower, and now are completely shrivelled up and dormant again. On the other hand, those species of the Arid Karoo which have penetrated into these parts, e.g. *Stipagrostis obtusa*, *Asaenia axillaris* and *Aptosimum marlothii*, are flourishing and in full flower, as are the mesembs—from their point of view, conditions are more or less normal.

The western boundary of the False Arid Karoo is clearly defined—west of it, the plants of the Central Upper Karoo are confined to the hills; but the eastern boundary is not clearly defined, the Arid Karoo elements merely becoming gradually less prominent and the veld more typically Central Upper Karoo.



FIG. 71.—False Arid Karoo (35) at Vaalwater, near Matsap in Griqualand West in the Cape. Species noted: *Stipagrostis obtusa*, *Eragrostis lehmanniana*, *E. truncata*, *Enneapogon desvauxii*, *Osteospermum leptolobum*, *Pentzia incana* and *Zygophyllum* spp.

### 36 FALSE UPPER KAROO

The development of this veld type constitutes the most spectacular of all the changes in the vegetation of South Africa. The conversion of 32,200 square km of grassveld into eroded Karoo<sup>51,52</sup> can only be regarded as a national disaster.

This veld, as regard the plains, scarcely differs in appearance from the Central Upper Karoo, except that it has more grassiness, mainly *Aristida adscensionis*, *A. congesta* subsp. *barbicollis* and *Eragrostis lehmanniana*, especially in the eastern part of it. It is probable that the original grassveld extended as far west as the western watershed of the Seacow River, i.e. roughly- a line through Murraysburg, Richmond and Petrusville, the country westwards to the boundary shown on the map, being transitional, predominantly grassy, but fluctuating towards the Karoo condition during droughts. At no time can steekgras be visualized as the dominant grass under natural conditions.

In detail, however, there are differences. In the False Karoo it will be found that:

The hills are still essentially of grassveld type and complete grassveld occurs in protected places.

The principal shrub on the hills is *Rhus erosa*, which does not occur in the Central Upper Karoo, even on grassy hills, but does extend north-eastwards into the grassveld as far as Bethlehem.

A grass of general occurrence, though now rare, is *Tetrachne dregei*, also not occurring in the Central Upper Karoo, but extending far into wetter regions to the north and east.

The farmer who introduced Merino sheep into the Colesberg division in the middle of the last century has given us a description of how the sheep converted the sweet grassveld of the country between the Sneeuberg and the Orange River into eroded Karoo. Unfortunately he does not name the grasses, but he does call this area "one of the prime sheep-walks of the Colony", so it can hardly have been the sea of *Aristida* and *Eragrostis* which appears after a good rainy season to-day.

Early travellers speak of the complete absence of firewood in this region, but even the botanists among them are vague about the botanical composition of the vegetation. To these early travellers, however, the Karoo was the Little Karoo and Great Karoo; they did not count the Upper Plateau as Karoo.

Schulze has shown that along the western boundary of the False Karoo there is a change in climate from tropical to temperate.

The False Karoo (Fig. 72) is to-day still advancing into grassveld, and that of a much wetter type than the grassveld with which we are dealing. The pioneer of the False Karoo is *Chrysocoma tenuifolia*.

The south-eastern portion of the False Karoo, in the basin of the Upper Great Fish River and its tributaries, is somewhat different from the rest, being involved also in an invasion of Lower Central Karoo up the Great Fish River valley, so that there is a higher proportion of succulents in the False Karoo here, with *Pentzia incana* the dominant karoo bush instead of *P. globosa*.

The False Karoo types are inclined to be sparser than the genuine Karoo types, especially near their upper margins, because, until the grassveld soil has eroded away, the Karoo has no secure foothold. It cannot protect the soil from erosion and does not need it; so only when the harder subsoil or the bare rock has been exposed, does the invading Karoo feel happy, and only then does the full mixture of Karoo species come in. In the marginal grassveld zone the activities of the large population of Harvester termites becomes conspicuous when the grass-cover becomes insufficient to supply the needs of the termites as well as the needs of the grazing animal. Killing the termites will not restore the grass unless enlightened veld management is practised at the same time.

To a smaller extent than the Central Upper Karoo, this veld type has been invaded by elements of the Arid Karoo, almost to its eastern limits, but they are inclined to be sensitive as regards habitat. Thus *Stipagrostis obtusa*, which might be valuable in covering up the bare soil, only grows in places where there is a layer of sand over calcareous tufa, in cases where *Eragrostis bergiana* is not already in possession. In passing, it may be pointed out that, around Middelburg, *Eragrostis bergiana* in such habitats will grow so densely as to have a basal cover of 60 per cent. The leaves are so short, however, that it can only be grazed when the stolons curl up off the ground during a drought.



FIG. 72.—False Upper Karoo (36) near Reddersburg in the southern Orange Free State. Species noted: *Pentzia globosa*, *Chrysocoma tenuifolia*, *Felicia muricata*, *Berkheyia annectens*, *Walafrida saxarilis*, *Eragrostis chloromelas*, *E. obtusa* with *Themeda triandra* surviving in the distance on the left.

### 37 FALSE KARROID BROKEN VELD

(See Reynolds, Pl. 29; White, Dyer and Sloane, Fig. 398)

This veld type (Fig. 73) much resembles the Great Karoo form of the Karroid Broken Veld, but, occurring in a less arid region, is taller, denser and slightly less desertlike; but it has more than one origin.

(1) From Aberdeen to Bruintjieshoogte along the foot of the mountains, and up the Great Fish River valley to Cradock, it is probably the result of invasion, by Central Lower Karoo and Karroid Broken Veld, of an open grassy shrub savanna marginal to the Spekboomveld and scrub of the lower mountain slopes, accompanied by destruction of the grass cover and soil erosion. A similar process can still be seen going on on the lower northern slopes of these same mountains.

(2) In the lower part of the Upper Great Fish River basin, north of Cradock, it is probably the result of spread of elements of the open, grassy Karroid Broken Veld scrub of the mountains and of invasion by Central Lower Karoo, into grassveld of Dry *Cymbopogon-Themeda*-Veld type, accompanied by the grazing out and eroding out of the grassveld.

(3) In this same region (on steep mountain sides), and down the valleys of the Great Fish River and its tributaries towards Grahamstown, it is the result of thinning out or destruction of Valley Bushveld, Spekboomveld and Fish River Scrub, eating out of the grassveld associated with these veld types, erosion, and invasion by Central Lower Karoo. The sudden destruction of the prickly pear in recent years has given it a further chance to spread.

(4) Along the foot of the mountains from Somerset East to Debe Nek, and in the basin of the Upper Black Kei, we can see the beginnings of another method of development of False Karroid Broken Veld—*Acacia karoo* invades from the south and east, Central Lower Karoo and Central Upper Karoo invade from the west, and both contribute towards the destruction of the grassveld. As has been pointed out above (p. 8), a similar danger exists in the western parts of the Orange Free State and Transvaal.

(5) Although distinctive enough to be kept as a separate veld type, the result of invasion of Kalahari Thornveld and Vryburg Shrub Bushveld by Karoo is also, of course, Karroid Broken Veld.

(6) There are signs, in the Middelburg area, that *Acacia karoo* is spreading into the False Karoo of the upper plateau; the result of such a spread would also be False Karroid Broken Veld. A distinctive species of the False Karroid Broken Veld of the Eastern Cape is *Bacium burchellianum*.

### 38 FALSE CENTRAL LOWER KAROO

This veld type is of limited area, occurring in the lower and flatter parts of the shallow valleys below the mountains from Aberdeen to Adelaide, in that zone which is visualized as having been marginal grassveld or shrub savanna. It differs from the False Karroid Broken Veld in lacking trees and shrubs, and lacks the short denseness of the genuine Central Lower Karoo, but has the same species.

### 39 FALSE SUCCULENT KAROO

This is a somewhat vague type, because, as has been pointed out already (p. 8), the country where it occurs is hardly suitable for it, so that it is inclined to be desert, sparsely populated with mesembs and relics of the Arid Karoo. Seeing that the reason for its development is excessive grazing pressure, the species that are of value for grazing will be precisely the ones that do not appear in it. This phenomenon is of general application to all the "False" veld types.

These are the names of such species as have been determined; there are many more, especially in the stony wilderness to the east and south-east of the Kamiesberg:—

<i>Ruschia robusta</i>	<i>Psilocaulon absimile</i>
<i>R. ferox</i>	<i>P. arenosum</i>
<i>R. muricata</i>	<i>Sphalmanthus suffusus</i>
<i>R. leucanthera</i>	<i>S. tetragonus</i>
<i>R. leucosperma</i>	<i>Aridaria sp. cf. A. noctiflora</i>
<i>R. kakamasensis</i>	<i>Hereroa fimbriata</i>
<i>R. uncinella</i>	<i>Drosanthemum framesii</i>
<i>R. sp. = A. 15062</i>	<i>Herrea nelii var.</i>
<i>Brownanthus ciliatus</i>	



FIG. 73.—False Karroid Broken Veld (37) north of Ann's Villa in the Cape. Species present: *Euclea undulata*, *Pappea capensis*, *Cussonia spicata*, *Acacia karoo*, *Schotia afra* var. *afra*, *Aloe ferox*, *Pentzia incana*, *Bacium burchellianum*, *Chrysocoma tenuifolia*, *Asparagus striatus*, *Drosanthemum lique*, *D. hispidum* and *Eragrostis obtusa*.

*Ruschia robusta* is the most important, covering large areas of gravelly country. Another important succulent at times is the annual *Augea capensis*.

It is possible that much of the Steytlerville Karoo should be counted as False Succulent Karoo, but this veld type requires more study.

#### 40 FALSE ORANGE RIVER BROKEN VELD

In the Orange River valley and the Strydenburg area, this takes the form of the development of thickets of *Acacia mellifera* subsp. *detinens* and *Rhigozum trichotomum* (Fig. 74), with a little *Phaeoptilum spinosum*, *Boscia albitrunca*, *Cadaba aphylla* and stunted *Acacia tortilis* subsp. *heteracantha* in false Arid Karoo. In valleys and on silty flats, *Sphalmanthus tetragonus* and *Psilocaulon absimile* become abundant.

In the Vaal River valley, it takes the form of invasion of the Vryburg scrub bushveld by *Acacia mellifera* subsp. *detinens* and *A. tortilis* subsp. *heteracantha* often forming thickets, with more or less of the Karoo constituent of the Orange River Broken Veld. Similar patches of False Orange River Broken Veld are developing on a small scale on

limestone outcrops in the valleys between the Kuruman Hills and the Langeberg, at least as far north as Kathu.

#### 41 PAN TURF VELD INVADED BY KAROO

Where the turf-y soil still covers the calcareous tufa, the vegetation is inclined to become very sparse and stunted, at least as regards perennials (Fig. 75). It consists mainly of:

<i>Enneapogon desvauxii</i>	<i>Lycium oxycladum</i> (dwarf)
<i>Eragrostis bicolor</i>	<i>Pentzia globosa</i>
<i>Cyperus usitatus</i>	<i>Sporobolus tenellus</i>
<i>Felicia muricata</i>	<i>Salsola humifusa</i>
<i>Nestlera conferta</i>	<i>S. glabrescens</i>
<i>Asparagus</i> sp. (stiff glaucous)	

sometimes with abundance of the annuals *Aristida adscensionis*, *Chloris virgata*, *Tragus berteronianus*, *Tribulus terrestris*, *Brachiaria marlothii* and *Sporobolus coronandelianus*. As the floors of the pans dry up after being flooded, *Diplachne fusca* sometimes covers them with a sheet of green; no doubt the original vegetation of the pans was a permanent *Echinochloa holubii* veld, of which *Diplachne fusca* was a constituent.



FIG. 74.—False Orange River Broken Veld (40) west of Luckhoff in the south-eastern Orange Free State showing dark patches of *Rhigozum trichotomum*.



FIG. 75.—Pan Turf Veld invaded by Karoo (41) 64 km E.N.E. of Boshof in the western Orange Free State. Species noted: *Eragrostis tricophora*, *E. lehmanniana*, *E. obtusa*, *Sporobolus ludwigii*, *S. tenellus*, *S. ioclada* and patches of *Themeda triandra* with *Nestlera conferta*, *Salsola humifusa*, *Felicia muricata*, *Pentzia virgata* and *Dimorphotheca zeyheri*.

But where the calcareous tufa is exposed, the False Karoo is much more complete, often with relics of *Themeda*, and sometimes with a dense mat of *Eragrostis bergiana* and *Tragus koelerioides* as in the False Karoo of the Naauwpoort—Middelburg—Hofmeyr area; thus it is quite a good karoo veld with:—

<i>Eragrostis bergiana</i>	<i>Berkheya annectens</i>
<i>Sporobolus ludwigii</i>	<i>Geigeria ornativa</i>
<i>S. tenellus</i>	<i>Digitaria argyrograpta</i>
<i>Cyperus usitatus</i>	<i>Eragrostis bicolor</i>
<i>Felicia muricata</i>	<i>Vahlia capensis</i>
<i>Eragrostis lehmanniana</i>	<i>Alloinopsis sp.</i>
<i>Themeda triandra</i>	<i>Theesium hystrix</i>
<i>Blepharis integrifolia</i>	<i>Urginea pusilla</i>
<i>Pentzia incana</i>	<i>Cymbopogon plurinodis</i>
<i>P. globosa</i>	<i>Gnidia polycyphala</i>
<i>Nestleria conferta</i>	<i>Lycium oxycladum (dwarf)</i>
<i>Nenax microphylla</i>	<i>Heliotropium stednieri</i>
<i>Tragus koelerioides</i>	<i>Justicia orchoides</i>
<i>Stachys spathulata</i>	<i>Panicum coloratum</i>
<i>Fingerhuthia africana</i>	<i>Falkia oblonga</i>

and many more.

It is suspected that further study will show that a good deal of the False Karoo in the southern part of the Orange Free State, west of the Reddersburg—Bloemfontein Road, would better be included in this veld type, or a variation of it, likewise the flood plains in the Middelburg area.

## 42 KARROID MERXMUELLERA MOUNTAIN VELD REPLACED BY KAROO

This veld type occurs on the mountains north of Beaufort West and on the mountains between Murraysburg and Somerset East and Cradock; actually, it could well have been shown as occurring around the margin of nearly all the Karroid *Merxmuellera* Mountain Veld. It tends to develop mainly in the valleys, where grazing is heaviest and most continuous; but in the case of some of the lower mountains it has reached the top, where it becomes semi-succulent, with bushy *Ruschia* spp.

At its lower margin, it is indistinguishable from ordinary False Upper Karoo (or False Central Lower Karoo on the south side of the mountains), except for occasional tufts of *Merxmuellera disticha*\* and relics of complete Karroid *Merxmuellera* Mountain Veld on well cared for farms. At higher levels, however, it has some distinctive features, tending to be tall and becoming transitional to the False Karroid Rhenosterbosveld (p. 000) which has invaded so much of the higher parts of the Karroid *Merxmuellera* Mountain Veld; here it represents the Western Mountain Karoo of more arid regions westwards, and includes the following species as typical:—

<i>Chrysocoma tenuifolia</i>	<i>Selago albida</i>
<i>Dimorphotheca cuneata</i>	<i>Felicia filifolia</i>
<i>Nestleria prostrata</i>	<i>Pteronia tricephala</i>
<i>Walafrida saxatilis</i>	<i>P. glauca</i>
<i>Selago brevifolia</i>	<i>Lightfootia albens</i>
<i>Erioccephalus punctulatus</i>	<i>Euryops oligoglossus</i>
<i>Pentzia globosa</i>	<i>Passerina montana</i>
<i>P. punctata</i>	<i>Elytropappus rhinocerotis</i>
<i>Helichrysum hamulosum</i>	

an many more.

Usually there are relics of *Merxmuellera disticha*, *Themeda triandra*, *Cymbopogon plurinodis*, *Aristida diffusa* var. *burkei*, *Eragrostis chloromelas*, *E. lehmanniana*, etc., their abundance depending on the completeness of the replacement of the grassveld by Karoo.

A feature of this veld type is soil erosion, still very actively removing the deep, black vlei soil of the mountain valleys. Here and there, also, one finds patches of soil on the slopes, that give one an idea that the lower slopes, at least, of the False Karoo mountains were formerly covered with soil to considerable depth. As one goes eastwards one can find various stages in the removal of such a mantle of soil, e.g. along the Bamboesrand at the edge of the False Karoo, or along the edge of the White Kei valley between Queenstown and Lady Frere. The loss of this soil is, for practical purposes, irreparable.

## 43 MOUNTAIN RHENOSTERBOSVELD

As it is shown on the map, this veld type does not include by any means all of the Rhenosterveld occurring on the mountains of the Cape, only that falsely karroid part of it where the rhenosterbos (Fig. 76) appears to be the natural dominant, or, at least, shows no sign of being an invader into some other veld type. Thus, to-day, a good deal of what is shown as False Fynbos is more or less rhenosterbosveld, and so is much of the Karroid *Merxmuellera* Mountain Veld, but in these cases there can be no doubt that the rhenosterbos is an invader. In this small-scale map, therefore, these invasions have been ignored, but they will be described when the veld types which they have invaded are being considered.

The Mountain Rhenosterbosveld is included in the False Karoo types because its former grassiness, of southern type, of which *Merxmuellera stricta* is the chief relic to-day, has largely been replaced by Karoo. The Coastal Rhenosterbosveld is of different affinity, non-karroid and replacing tropical scrub and grassveld, i.e. it is of higher successional rank, equal to that of the non-karroid rhenosterbosveld which replaces Fynbos.

It may be that the Mountain Rhenosterbosveld, in its original grassy condition, is to the Fynbos what the thornveld is to the tropical forest, and is to the Karoo what the thornveld is to the Valley Bushveld.

The typical species include:—

<i>Elytropappus rhinocerotis</i>	<i>Ruschia multiflora</i>
<i>Relhania squarrosa</i>	<i>R. cymosa</i>
<i>R. genistaeifolia</i>	<i>Galenia africana</i> var. <i>africana</i>
<i>Erioccephalus africanus</i>	<i>Asparagus capensis</i>
<i>Euryops lateriflorus</i>	<i>Zygophyllum spinosum</i>
<i>Pentzia incana</i> (tall)	<i>Felicia filifolia</i>
<i>Chrysocoma tenuifolia</i>	<i>Dimorphotheca cuneata</i>
<i>Polygala myrtifolia</i>	<i>Ehrharta calycina</i>
<i>Helichrysum hamulosum</i>	<i>Merxmuellera stricta</i>
<i>Walafrida saxatilis</i>	<i>Lasiochloa longifolia</i>
<i>W. articulata</i>	<i>Cotyledon wallichii</i>
<i>Selago albida</i>	(sometimes) <i>Gnidia nitida</i>
<i>Phymaspermum</i> sp. (= A. 14642)	
<i>Pteronia incana</i>	

Around Touws River are some interesting transitions to Fynbos, Western Mountain Karoo and Succulent Karoo.

## V TEMPERATE AND TRANSITIONAL FOREST AND SCRUB TYPES

By "temperate forest" is meant the forest of relatively temperate habitats; although it includes a higher proportion of southern species than does the coastal forest, it is still essentially of tropical affinity.

\* Formerly *Danthonia disticha*



FIG. 76.—Mountain Rhenosterbosveld (43) near Springbok in the north-western Cape. Species noted: *Elytropappus rhinocerotis*, *Galenia africana*, *Pentzia globosa*, *Pteronia incana*, *P. divaricata*, *Rhus undulata*, *Ruschia caroli* and *Eriocephalus* spp. with *Acacia karroo* along stream and *Didelta spinosa* in rockier places.

#### 44 (a) HIGHLAND SOURVELD

(See Marloth I, Pl. 10; III, 2 Fig. 110; Taljaard, Photos 106, 107, 108, 109, 110)

This is the veld of the eastern slopes and foothills of the Drakensberg from about 1 350—2 150 m above the sea, extending over the top of the escarpment on to the edge of the Upper Plateau in the lower part of the range between Mont-Aux-Sources and Volksrust (Figs. 77 and 78). Outliers occur on the Helpmekaar, Qudeni-Babanango and Mahlabatini plateaux at somewhat lower elevations, but these outliers are transitional to the North-Eastern Mountain Sourveld. Rainfall ranges from 750-1 500 mm per annum, falling in summer; frosts are severe in winter, and snow falls at the higher altitudes. It is rolling country, falling steeply into the numerous valleys, where the vegetation is Tall Grassveld.

It is probable that the whole area was originally forest and scrub-forest, but relics are few and small, and badly mutilated.

Trees of general occurrence are:—

<i>Leucosidea sericea</i> ..	1 455	<i>Halleria lucida</i> ....	194
<i>Trimeria grandifolia</i> .....	646	<i>Rapanea melanophloeos</i> ...	133
<i>Heteromorpha arboreascens</i> ....	558	<i>Olinia</i> spp.....	131
<i>Podocarpus latifolius</i> .....	214	<i>Scolopia mundii</i> ...	102
		<i>Kiggelaria africana</i> .	34

Trees of less general occurrence are:—

<i>Scolopia flanaganii</i>	357	<i>Calodendrum capense</i> .....	28
<i>Cryptocarya woodii</i>	356	<i>Celtis africana</i> ....	28
<i>Ptaeroxylon obliquum</i> .....	247	<i>Podocarpus falcatus</i>	17
<i>Apodytes dimidiata</i>	30	<i>Fagara davyi</i> .....	13
<i>Pittosporum viridiflorum</i> .....	29	<i>Maytenus acuminata</i> var. acuminata.....	5

The dominant tree is clearly *Podocarpus latifolius*: the indicators will be this species as dominant with *Canthium ciliatum* dominant in the undergrowth and *Leucosidea sericea* at the margin. *Leucosidea* becomes the dominant, at the upper edge of the veld type, in scrub forest with Fynbos and *Widdringtonia nodiflora*.

Shrubs and climbers of general occurrence are:—

<i>Senecio deltoideus</i> ..	5 205	<i>Buddleia salviifolia</i>	122
<i>Canthium ciliatum</i> ..	3 616	<i>Myrsine africana</i> ..	117
<i>Diospyros whyteana</i> .....	1 553	<i>Rhamnus prinoides</i>	115
<i>Clausena anisata</i> ..	821	<i>Maytenus heterophylla</i> ....	74

<i>Scutia myrtina</i> ....	677	<i>Cassinopsis ilicifolia</i> .....	41
<i>Canthium pauciflorum</i> .....	554	<i>Rhus transvaalensis</i>	7
<i>Carissa bispinosa</i> ..	468	<i>Osyridicarpus schimperianus</i> ...	4
<i>Clematis brachiata</i> ..	405		
<i>Grewia occidentalis</i>	396		

Shrubs and climbers of less general occurrence include:—

<i>Asparagus setaceus</i>	959	<i>Maytenus mossambicensis</i>	
<i>Cissampelos torulosa</i> .....	937	var. <i>ruber</i> .....	196
<i>Peddiea africana</i> ....	711	<i>Rubus pinnatus</i> ....	155
<i>Senecio mikanioides</i> .....	600	<i>Calpurnia aurea</i>	
<i>Maytenus mossambicensis</i> ..	556	subsp. <i>sylvatica</i> ..	120
<i>Rhoicissus tridentata</i> .....	382	<i>Secamone alpini</i> ...	52
<i>Behnia reticulata</i> ..	233	<i>Andrachne ovalis</i> ..	30
<i>Strophanthus speciosus</i> .....	233	<i>Sparmannia ricinocarpa</i> .....	17
<i>Senecio tamoides</i> ..	220	<i>Dovyalis rhamnoidea</i> .....	12
		<i>Euclea natalensis</i> ..	4
		<i>Dais cotinifolia</i> ....	2

Sometimes *Greyia sutherlandii* and *Aloe arboreascens* are conspicuous on krantzies.

Smaller plants of general occurrence are:—

<i>Stipa dregeana</i> var. <i>elongata</i> .....	7 201	<i>Pteridium aquilinum</i> .....	2 501
<i>Polystichum luctuosum</i> .....	3 191	<i>Ehrharta erecta</i> ....	2 442
<i>Brachypodium flexum</i> .....	3 125	<i>Argyrolobium tomentosum</i> ....	1 467
<i>Asparagus virgatus</i>	3 043	<i>Solanum aculeatissimum</i> ..	34
<i>Galopina circaeoides</i> .....	2 723		

Of less general occurrence are:—

<i>Cyperus albostriatus</i> .....	15 831	<i>Schoenoxiphium sparteanum</i> var. ....	1 006
<i>Hypoestes verticillaris</i> .....	14 464	<i>Galium rotundifolium</i> ....	907
<i>Australina acuminata</i> .....	5 701	<i>Clutia pulchella</i> ...	870
<i>Opismenus hirtellus</i> .....	5 581	<i>Panicum aequinerve</i>	817
<i>Streptocarpus rexii</i>	4 610	<i>Achyranthes aspera</i>	797
Other Acanthaceae	3 289		
<i>Impatiens duthieae</i>	2 226	<i>Polygala ohlendorfiana</i> ....	714
<i>Asplenium aethiopicum</i> ....	1 078	<i>Poa binata</i> .....	512
<i>Geranium ornithopodium</i> ....	1 042	<i>Pellaea viridis</i> ....	490
		<i>Peperomia tetraphylla</i> .....	366

and many more, the total number of species in the Relative Abundance Table being 367.

FIG. 77.—Highland Sourveld (44a) in the Collings Pass area of north-western Natal.



FIG. 78.—Upper limits of Highland Sourveld (44a) bordering *Themeda-Festuca* Alpine Veld (58) on the Little Berg in the Cathkin-Cathedral Peak area. The dominant grass is *Themeda triandra*.

The grassveld, Highland Sourveld, which replaces this forest, is, in the more level parts, a pure grassveld, lacking the thorns and scrubiness of warmer types. On the mountain slopes, however, there may be a good deal of scrubiness, and, in parts, this veld is a savanna of *Protea multibracteata* and/or *P. roupelliae*.

Generally occurring species of the Highland Sourveld are:—

<i>Themeda triandra</i> ...	323 220	<i>Eragrostis plana</i> ...	5 029
<i>Tristachya hispida</i> ...	215 900	<i>Hyparrhenia hirta</i> ...	3 638
<i>Trachypogon spicatus</i> .....	169 617	<i>Aristida junciformis</i>	3 487
<i>Heteropogon contortus</i> .....	144 789	<i>Diheteropogon amplexans</i> .....	3 248
<i>Eragrostis racemosa</i> ...	135 940	<i>Acalypha schinzii</i> ...	3 008
<i>Diheteropogon filifolius</i> .....	78 768	<i>Panicum ecklonii</i> ...	2 472
<i>Monocymbium ceresiiforme</i> .....	43 763	<i>P. natalense</i> .....	1 786
<i>Rendia altera</i> .....	30 632	<i>Hypoxis rigidula</i> ...	1 033
<i>Alloteropsis semialata</i> .....	29 617	<i>Eulalia villosa</i> .....	820
<i>Microchloa caffra</i> ...	27 838	<i>Pentanisia prunelloides</i> .....	746
<i>Eragrostis capensis</i> ...	10 413	<i>Helichrysum latifolium</i> .....	722
<i>Harpochloa falx</i> ...	7 303	<i>Haplocarpha scaposa</i> .....	243

Of less general occurrence are:—

<i>Elionurus argenteus</i>	10 927	<i>Sporobolus centrifugus</i> .....	1 100
<i>Ficinia</i> spp. ....	6 715	<i>Kohautia amatymbica</i> .....	1 009
<i>Digitaria monodactyla</i> ....	3 837	<i>Indigofera hilaris</i> ...	928
<i>Andropogon appendiculatus</i> ...	2 730	<i>Helichrysum rugulosum</i> .....	888
<i>Brachiaria serrata</i> var. <i>serrata</i> .....	2 440	<i>Eriosema kraussianum</i> .....	828
<i>Andropogon schirensis</i> .....	1 954	<i>Helichrysum simillimum</i> .....	766
<i>Bulbostylis</i> sp. ....	1 690	<i>H. aureo-nitens</i> .....	721

and many more, the total number of species in the Relative Abundance Table being 171.

This veld is easily reduced to *Eragrostis plana* by trampling and selective grazing by cattle, while in veld overgrazed by sheep, *Acalypha schinzii* tends to dominate. Much work has been done on the reactions of this veld to grazing management at Ntabamhlope Research Station. It is capable of intensification, but, with its dry, frosty winters, hail storms in summer, deep but leached soils and short growing season, it is difficult country for farming.

#### 44 (b) THE DOHNE SOURVELD

This veld type is generally very similar to the Highland Sourveld, but lies at lower altitudes, 600-1 350 m above sea-level, is warmer, and drier, receiving 650-1 000 mm of rain per annum, and no snow in winter except on the tops of the mountains (Fig. 10). Soils are less thoroughly leached, in the drier parts having an erodible subsoil at no great depth, so that soil erosion is more in evidence than in the Highland Sourveld, though generally occurring only as single dongas or systems of dongas. Relics of forest are more numerous, larger and better preserved (the succession to forest being stronger in this less frosty region), especially south-westwards on the Amatolas and other mountains to Somerset East. Some of these mountains are still covered with forest from top to bottom, though much of it has been reduced to scrub forest.

Trees of general occurrence are:—

Trichocladus ellipticus.....	1 355	Canthium ventosum.....	61
Halleria lucida.....	592	Celtis africana.....	52
Trimeria grandifolia.....	430	Curtisia dentata....	50
Podocarpus falcatus	231	Xymalos monospora.....	27
P. latifolius.....	175	Kiggelaria africana	19
Rhus chirindensis forma legatiæ.....	174	Linociera foveolata	18
Rapanea melanophloeos...	130	Calodendrum capense.....	15
Scolopia mundii.....	81	Heteromorpha arborescens.....	11
Vepris undulata...	75	Maytenus peduncularis.....	9
Pittosporum viridiflorum.....	69	Cussonia spicata...	8
Olea capensis subsp. macrocarpa.....	68	Scolopia zeyheri...	8
		Ilex mitis.....	7

Trees of less general occurrence include:—

Dovyalis spp.....	283	Pterocelastrus tricuspidatus.....	11
Apodites dimidiata	30	Hippobromus pauciflorus.....	10
Ptaeroxylon obliquum.....	24	Podocarpus henkelli	
Scolopia flanaganii	23	(northwards)....	7
Allophylus decipiens.....	21	Maytenus acuminata var.	
Pleurostylia capensis.....	16	acuminata.....	7
Leucosidea sericea	16		
Cassine papillosa..	13		

Shrubs and climbers of general occurrence are:—

Canthium ciliatum	2 875	Secamone alpini...	582
Scutia myrtina....	2 606	Maytenus heterophylla.....	580
Behnia reticulata..	1 940	Asparagus setaceus	474
Cissampelos torulosa.....	1 854	Strophanthus speciosus.....	385
Grewia occidentalis	1 774	Maytenus mossambicensis..	342
Rhoicissus tridentata.....	1 602	Diospyros whyteana	95
Calpurnia aurea subsp. sylvatica..	1 511	Cassinopsis ilicifolia.....	81
Diospyros scabrida var. cordata....	743	Fagara capensis....	53
Senecio deltoideus.	715	Rhamnus prinoides	26
Carissa bispinosa..	583	Burchellia bubalina	14

Shrubs and climbers of less general occurrence in the Dohne Sourveld forests include:—

Gardenia amoena..	559	Senecio mikanioides....	157
Senecio tamoides..	376	Dalbergia obovata.	156
Andrachne ovalis..	330	Pavetta kotzei....	118
Canthium pauciflorum....	288	Eugenia zuluensis..	81
Diospyros villosa..	256	Grewia lasiocarpa.	81
Maesa alnifolia ....	183	Rhoicissus digitata	81
Secamone frutescens.....	164	Cnestis natalensis..	78

and many more.

Species in the undergrowth of general occurrence are:—

Oplismenus hirtellus.....	20 275	Moraea iridioides..	4 072
Stipa dregeana var. elongata.....	17 411	Polystichum luctuosum.....	2 531
Centella asiatica....	14 116	Polyodium polypodioides...	2 097
Galopina ciraeoides	7 279	Streptocarpus rexii.	1 950
Cyperus albostriatus.....	6 378	Cymbopogon validus.....	924
Ehrharta erecta....	6 258	Clutia pulchella...	382

Of less general occurrence in the undergrowth are:—

Hypoestes verticillaris.....	25 916	Peperomia tetraphylla.....	1 214
Other Acanthaceae	15 578	Asparagus virgatus	1 183
Sanicula elata....	9 289	Plectranthus laxiflorus.....	1 148
Stachys aethiopica.	4 023	Asplenium aethiopicum....	984
Laportea peduncularis.....	2 467	Schoenoxiphium sparteum.....	804
Chileanthus bergiana.....	2 224	Plectranthus ecklonii.....	736
Argyrolobium tomentosum....	1 977	Polygala ohlendorfiana....	677
Selaginella kraussiana.....	1 354		

and many more, the total number of species in the Relative Abundance Table being 468.

This forest has far more climbers and is richer in species than the forest of the Highland Sourveld. *Podocarpus falcatus* is here the dominant, but *P. latifolius* is still almost as numerous as in the Highland Sourveld forests; so the indicators will be *Podocarpus falcatus* and *P. latifolius* as dominants, with *Canthium cliatum* and *Trichocladus ellipticus* in the undergrowth. This complete dominance of *Podocarpus* at once distinguishes these forests from those previously described and justifies the name "Temperate Forests."

This forest further resembles the Highland Sourveld forest, especially on the mountains from the Amatolas westwards, in being associated with Fynbos. The Fynbos occurs on rocky outcrops on the grassy mountain tops and at the forest margin, particularly the upper margin. It includes such species as:—

Protea lacticolor	Pelargonium cordatum
Widdringtonia sp.	Cliffortia linearifolia
Aspalathus frankenoides	C. paucistaminea
Myrica brevifolia	Erica brownleeae
Arrowsmithia stypeliaoides	E. caffra
Phyllica simii	Anthospermum aethiopicum
Struthiola parviflora	Macowanias revoluta
Macowanias revoluta	Metalasia muricata
Stoebe vulgaris	Agathosma ovata

and others.

It is thus a more complete Fynbos than that of the Drakensberg.

The Dohne Sourveld which replaces this forest is also a dense, sour grassveld. At Dohne Research Station, average basal cover is 30 per cent, ranging from about 18 per cent to 40 per cent, according to grazing treatment. Species of general occurrence are:—

Themeda triandra..	537 723	Microchloa caffra..	26 395
Heteropogon contortus.....	373 877	Senecio retrofrus..	10 121
Tristachya hispida.	261 200	Harpochloa falx...	7 818
Eragrostis capensis	144 042	Eragrostis plana...	3 100
Sporobolus africanus.....	48 652	Brachiaria serrata	
Elionurus argenteus	28 942	var. serrata.....	1 952
		Rhynchosia totta..	1 666

Species of less general occurrence in the Dohne Sourveld include:—

Eragrostis racemosa.....	Eulalia villosa.....	4 517
Trachypogon spicatus.....	Cyperus obtusiflorus var. flavissimus.....	3 067
Eragrostis chloromelas.....	Anthospermum sp..	2 607
Setaria nigrirostris	Hypoxis argentea..	1 878
Digitaria monodactyla....	Allotropis semialata.....	1 464
Ficinia spp.....	Sporobolus centrifugus.....	1 201
Andropogon appendiculatus....		5 077

and many more, the total number of species in the Relative Abundance Table being 255.

This veld type shows a good deal of variation. North of the Umzimvubu River it merges into the Pondoland Plateau Sourveld; in sandy valleys in the Mount Fletcher area it is sparser, with a good deal of *Aristida junciformis*, while in its westward extension to the Katberg, Winterberg and Boschberg, it is transitional to the wetter upper margin of the Karroid *Merxmuellera* Mountain Veld, with abundance of *Bromus firmior*, *Festuca longipes*, *F. costata*, *Tetraparia cispidata*, *Lasiochloa longifolia*, *Karroocholoa curva*, *Pennisetum sphacelatum* and *Helictorichon* spp., although the usual species are still the dominants. That is to say, the grassveld, like the forest, has a strong southern element.

Mismanagement of this veld by selective grazing encourages *Eliomurus argenteus* rather than *Eragrostis plana*, and, at lower altitudes, brings in such an abundance of *Senecio retrorsus* that it attracts visitors from neighbouring districts to see it flowering. Counts have shown that in a bad infestation there may be 500 000 or more plants of *Senecio* per hectare. A characteristic plant of disturbed soil is the big bushy *Senecio pterophorus*. At higher altitudes, on the Amatola mountains overgrazing has other effects: Sometimes it causes *Helichrysum argyrophyllum* to invade and ultimately replace the grassveld, whitening the shoulders of the mountains; sometimes it causes a False Fynbos, composed of elements of the local Fynbos relics, to invade the grassveld. The important species concerned in this invasion are *Cliffortia linearifolia*, *C. paucistaminea* and *Erica brownleeae*. A thorough study of the area has been made by Story (1952).

#### 45 NATAL MIST BELT 'NGONGONI VELD

(See Taljaard, Photo 115)

This is a transitional type between the 'Ngongoni Veld and the Highland Sourveld, lying at altitudes ranging from 900-1 350 m above the sea, and receiving 900-1 150 mm of rain per annum. It is misty country, which gives it an agriculturally more favourable climate than the Highland Sourveld and makes it well suited for intensive farming.

Little of the forest survives, except at the upper margin of the veld type where *Podocarpus* spp. are the dominants, but at lower levels they are scarcer. The coastal forest element is so strong, however, that it might have been better to group it with the 'Ngongoni Veld.

The trees of general occurrence are:—

Rapanea melanophloeos....	Cassipourea gummiflua var.	
Cryptocarya woodii	verticillata.....	83
Syzygium gerrardii	Vepris undulata...	14
Combretum kraussii.....	Celtis africana....	9
Xymalos monospora.....	Ficus natalensis...	9
	Kiggelaria africana	9
	Podocarpus falcatus	8

Halleria lucida.....	119	P. latifolius.....	8
Pittosporum viridiflorum.....	100	Calodendrum capense.....	5
Trimeria grandifolia.....	89	Cussonia spicata..	5
Fagara davyi.....	14	Trema orientalis..	5
Rhus chirindensis forma legitii.....	14	Canthium mundianum....	1
		Schefflera umbellifera.....	1

Trees of less general occurrence are scarce, they include:—

Leucosidea sericea..	6	Olinia spp.....	2
Cunonia capensis....	3	Podocarpus henkelii.....	2
Alberta magna.....	2	Protorhus longifolia	2
Allophylus melanocarpus....	2	Ptaeroxylon obliquum.....	2
Ficus craterostoma	2	Prunus africana...	2
Maytenus acuminata var.		Scolopia mundii...	2
acuminata.....	2		

Shrubs and climbers of general occurrence include:—

Dalbergia obovata	3 825	Tricalysia lanceolata.....	313
Uvaria caffra.....	2 500	Peddiea africana..	218
Cassinopsis ilicifolia.....	1 375	Clausena anisata..	210
Strophanthus speciosus.....	1 300	Maesa lanceolata..	130
Behnia reticulata..	1 255	Entada spicata...	130
Allophylus dregeanus.....	1 013	Secamone alpini...	100
Maytenus mossambicensis..	834	Burchellia bubalina	89
Carissa bispinosa..	743	Canthium ciliatum	89
Scutia myrtina ...	644	Rhoicissus tomentosa.....	89
Canthium gueinzii	482	Cissampelos torulosa.....	82
Grewia occidentalis	476	Rhoicissus rhomboidea....	82
Euclea natalensis..	313		

and many more.

Shrubs and climbers of less general occurrence include:—

Senecio deltoideus	1 250	Choristylis rhamnooides.....	63
Diöscorea dregeana	625	Myrica sp.....	63
Jasminum stenolobum.....	625	Senecio tamoides..	55
Diöscorea cotinifolia.....	363	Rubus cuneifolius..	36

In the undergrowth, the species of general occurrence are:—

Oplismenus hirtellus.....	85 050	Pteris catoptera....	2 081
Cyperus albostriatus....	18 340	Prosphytochloa prehensiliis.....	2 025
Galopina circaeoides.....	11 700	Argyrolobium tomentosum.....	1 563
Selaginella kraussiana.....	8 625	Carex spicato-paniculata	1 375
Plectranthus laxiflorus.....	7 325	Blechnum attenuatum.....	1 322
Sanicula elata....	5 750	Leonotis leonurus..	130
Hyparhenia sp....	4 680	Conostomium natalense.....	130
Panicum acuminerve	4 505	Euphorbia kraussiana.....	85
Polystichum luctuosum.....	3 938	Impatiens duthieae	25
Asparagus virgatus	2 709		
Pteridium aquilinum.....	2 348		

while the following are of less general occurrence:—

Hypoestes verticillaris.....	22 500	Achyranthes aspera	1 300
Australina acuminata.....	7 205	Chlorophytum sp..	625
Diplptera quintasii	5 625	Asplenium aethiopicum....	625

and many more, the total number of species in the Relative Abundance Table being 216.

The grassveld which replaces this forest is a definitely *Themeda*-dominated sourveld, relatively sparse, and to-day largely replaced by *Aristida junciformis*. Species of general occurrence are:—

<i>Themeda triandra</i> ..	489 600	<i>Brachiaria serrata</i>	
<i>Monocymbium ceresiiforme</i> .....	53 911	var. <i>serrata</i> .....	10 433
<i>Trachypogon spicatus</i> .....	40 067	<i>Eragrostis curvula</i> .	8 364
<i>Tristachya hispida</i> ..	30 836	<i>Alloteropsis semialata</i> .....	4 444
<i>Aristida junciformis</i>	23 032	<i>Andropogon schirensis</i> .....	3 337
<i>Eragrostis racemosa</i> .....	20 311	<i>Eragrostis capensis</i>	2 311
<i>Heteropogon contortus</i> .....	18 778	<i>Hyparrhenia hirta</i>	1 793
<i>Diheteropogon filifolius</i> .....	15 022	<i>Eragrostis plana</i> ...	170
		<i>Digitaria tricholaenoides</i> ...	70
		<i>Diodia natalensis</i> ..	39

Species of less general occurrence include:—

<i>Rendlia altera</i> .....	3 756	<i>Setaria nigrirostris</i>	876
<i>Digitaria diagonalis</i>	1 111	<i>S. sphacelata</i> .....	642
<i>Hypoxis rigidula</i> ...	1 111	<i>Diheteropogon amplexens</i> .....	558
<i>Loudetia simplex</i> ...	1 111	<i>Helichrysum rugulosum</i> .....	558
<i>Microchloa caffra</i> ..	1 111		
<i>Pteridium aquilinum</i> .....	1 111		

and many more, the total number of species in the Relative Abundance Table being 102.

Much of this region has been planted to exotic *Acacia* spp. and *Eucalyptus* spp., while another exotic, *Rubus cuneifolius*, is tending to spread into the grassveld.

#### 46 COASTAL RHENOSTERBOSVELD

This occurs in two blocks, one on the west coastal plain, undulating country, one on the south coastal plain, rolling country. In either case the soil is clayey and has been so completely ploughed up for growing wheat that relics of the natural vegetation are scarce and in poor condition. Altitude ranges from 0-300 m and rainfall from 300-500 mm per annum, falling in winter in the western block, mainly in winter, but partly in summer in the southern block, especially south of Swellendam.

The natural vegetation (Fig. 79) appears to have been scrub, perhaps, judging by relics, very dense and thorny, with *Olea africana* and *Sideroxylon inerme* the dominants. The lower part of the valleys in the southern block may have had a drier, semi-succulent scrub, in which *Acacia karroo*, *Aloe arborescens* and *Aloe ferox* were conspicuous; while the upper part of the valleys appears to have had a scrub forest transitional to the forest of the Langeberg.

The following species still occur in the southern coastal belt:—

<i>Cussonia spicata</i> W 1		<i>Carissa haematocarpa</i>	
<i>Buddleia saligna</i> W 1		<i>Pterocelastrus tricuspidatus</i>	
<i>Rhus lucida</i> W 1		<i>Cassine tetragona</i>	
<i>Grewia occidentalis</i> W 1		<i>Euclea racemosa</i>	
<i>Diospyros lycioides</i> subsp. <i>lycioides</i> W 1		<i>E. undulata</i>	
<i>Olea africana</i>		<i>Chrysanthemoides monilifera</i>	
<i>O. exasperata</i>		<i>Euphorbia rectirama</i>	
<i>Sideroxylon inerme</i>		<i>E. clandestina</i>	
<i>Maytenus heterophylla</i>		<i>Osyris lanceolata</i>	
<i>Rhus longispina</i>		<i>Acacia karroo</i>	
<i>R. glauca</i>		<i>Myrsine africana</i>	
<i>Azima tetracantha</i>		<i>Rhytidocarpus difformis</i>	
<i>Maytenus capitata</i>		<i>Aloe saponaria</i>	
<i>Sarcostemma viminale</i>		<i>Salvia africana-lutea</i>	
<i>Aloe ferox</i>		<i>Ehrharta aphylla</i>	
<i>Asparagus africanus</i>		<i>Merxmuellera disticha</i>	

i.e. a fairly complete scrub, related to the Gouritz River Scrub, but less succulent.

The only relic of the valley scrub of the rivers west of the Gouritz that has been seen, occurs on a small krantz in the Salt River valley on the Bredasdorp-Malagas Road. Here is the list made there:—

<i>Aloe ferox</i> F	<i>Asparagus suaveolens</i> lf
<i>Pteronia</i> sp. F	<i>Sideroxylon inerme</i> O
<i>Mesemb</i> , 2 spp. F	<i>Maytenus oleoides</i> r
<i>Ruschia</i> sp. cf. <i>R. hamata</i> f	<i>Zygophyllum morgsana</i> IFF
<i>Crassula lycopodioides</i> f	<i>Euphorbia burmannii</i> IFF
<i>Asparagus falcatus</i> f	<i>E. mauritanica</i> o
<i>Reilhania squarrosa</i> f	<i>Cassine tetragona</i> rt
<i>Carissa haematocarpa</i> f	<i>Asparagus asparagoides</i> o
<i>Rhus glauca</i> IF	
<i>Pteronia incana</i> IF	

etc., with *Acacia karroo*, F.; *Buddleia saligna* FF; *Atriplex vestita* C; *Melianthus major* ff, *Conyza ivae-folia* ff on the river banks, and *Suaeda fruticosa*, *Arthrocnemum natalense*, *Sporobolus virginicus* and mesembs on saline flats. This is a damaged relic but will serve to show that the Gouritz River Scrub, or something like it, occurred westwards in the valleys when the south coast belt was still covered with scrub, rather than the Little Karoo type of scrub which occurs in the Sondereinde River valley and in the Breede River valley around Bonnievale.

In the west coast belt, no good relics of the scrub have been seen, but there are indications, e.g. on the granite southern slopes of the Kanonberg, near Brackenfel Station, that it might have been more succulent and related to the Strandveld Scrub.

The Rhenosterbosveld which has replaced the scrub where the soil is not cultivated, is predominantly rhenosterbos, with more or less of the following:—

<i>Relhania squarrosa</i>	<i>A. linifolia</i>
<i>R. genistaefolia</i>	<i>Muraltia thymifolia</i>
<i>Selago corymbosa</i>	<i>M. filiformis</i>
<i>S. fruticosa</i>	<i>Polygalia fruticosa</i>
<i>Chrysanthemum carnosulum</i>	(sometimes C)
<i>Helichrysum</i> sp. cf. H. anomalam	<i>P. garcinii</i>
<i>Ruschia hamata</i>	<i>P. affinis</i>
<i>Aspalathus laricifolia</i>	<i>Hermannia flammnea</i>
<i>Osteospermum imbricatum</i>	<i>H. (saccifera) and others</i>
<i>Dicoma spinosa</i>	<i>Senecio pubigerus</i>
<i>Athanasia trifurcata</i>	<i>Chrysocoma tenuifolia</i>
	<i>Gnidia polystachya</i>

There is often much grass too, which, in protected places at the edge of lands, or in stony places which can never have been ploughed, is an extremely dense sward of *Themeda triandra*. *Themeda* is scattered through the Rhenosterbosveld, too, together with:—

<i>Ehrharta</i> sp.	<i>Lasiochloa longifolia</i>
<i>E. calycina</i>	<i>Aristida diffusa</i> var. <i>burkei</i>
<i>Merxmuellera disticha</i>	<i>Eragrostis capensis</i>
<i>M. stricta</i>	<i>E. curvula</i>
<i>M. rufa</i> and others	<i>Koeleria cristata</i>
<i>Cymbopogon plurinodis</i>	<i>Festuca scabra</i>
<i>Hyparrhenia hirta</i>	<i>Merxmuellera macowanii</i>
<i>Plagiochloa</i> sp.	(A. 15456)
<i>Brachiaria serrata</i> var. <i>serrata</i>	<i>Sporobolus africanus</i>
	<i>Helictotrichon capense</i>

At the upper margin of the south coastal Rhenosterbosveld, where it becomes transitional to False Fynbos and Coastal Fynbos, the sourveld grasses *Trachypogon*, *Heteropogon*, *Aristida junciformis* and *Stipagrostis zeyheri* subsp. *macropus* come in. Within the National Road enclosure between Mossel Bay and Swellendam, it is instructive to note how the grassveld is becoming dominant, the Fynbos becoming reduced to the status of forbs and *Elytropappus* suppressed. It will be interesting to see how long the scrub takes to start regenerating.

FIG. 79.—Coastal Rhenosterbosveld (46) at Riversdale in Cape with open cover of *Pentaschistis eriostoma* and *Aspalathus* sp.



The Rhenosterbosveld of the west coast belt is somewhat different, with an admixture of Fynbos and less grass. Such differences are due to the winter rainfall. At its lower margin it becomes semi-succulent and merges easily into the Strandveld. Little information is available about it.

#### 47 COASTAL MACCHIA

This occurs on sand and limestone in the west and south coastal belts (Fig 80). It has not been ploughed to the same extent as the Coastal Rhenosterbosveld. As in the case of the latter, there are indications that the climax is a grassy, more or less open scrub, at least on the south coast belt and on the Cape Flats. In the drier west coast belt, with its strictly winter rainfall, the climax is possibly a bush clump veld in grassy Fynbos. In either case it appears to have lacked the dense thorniness and semi-succulence of the scrub of heavier soils. Altitude ranges from 0-300 m and rainfall from 300-500 mm per annum. On the west coast the rain falls in winter, but on the south coast a proportion, increasing eastwards, falls in summer.

No doubt the Fynbos species always occurred, the tall ones taking their place with the tropical species in the scrub, the smaller shrubs and other plants taking the part of forbs in the grassy parts. It is doubtful if the tropical grasses were ever dominant in the west coast belt; the only ones that have been seen are *Themeda triandra* and *Hyparrhenia hirta*.

The grasses which still occur in the southern coastal part of the coastal Macchia include:

<i>Themeda triandra</i>	<i>Sporobolus africanus</i>
<i>Eragrostis capensis</i>	<i>Tristachya hispida</i> (eastwards)
<i>Aristida junciformis</i>	<i>Lasiocloa longifolia</i>
<i>Brachiaria serrata</i> var. <i>serrata</i>	<i>Eustachys mutica</i>
<i>Trachypogon spicatus</i>	<i>Eragrostis curvula</i>
<i>Digitaria litoralis</i>	<i>Microchloa caffra</i>
<i>D. eriantha</i>	<i>Pentaschistis</i> spp.
<i>Ehrharta</i> spp.	<i>Merxmuellera stricta</i> and other spp.
<i>Heteropogon contortus</i>	<i>Hyparrhenia hirta</i>
<i>Cymbopogon plurinodis</i>	
<i>Festuca scabra</i>	

Shrubs and trees (other than Proteaceae, etc., of the Fynbos) include:

<i>Euclea racemosa</i>	<i>camphoratus</i> var. <i>camphoratus</i>
<i>E. undulata</i>	
<i>Sideroxylon inerme</i>	<i>Rhus laevigata</i>
<i>Cassine peragua</i>	<i>R. lucida</i>
	<i>R. crenata</i>

*Maytenus heterophylla*  
*Pterocelastrus tricuspidatus*  
*Olea africana*  
*O. exasperata*  
*Linociera foveolata*

*R. glauca*  
*Myrsine africana*  
*Cynanchum obtusifolium*  
*Asparagus racemosus*

Scrub forest, up to 10 m high, composed of these species, is still to be found in the southern coast belt; but species are fewer in the west coast belt, and never, so far as has been seen, forming a scrub forest. The principal species are:—

<i>Maytenus heterophylla</i>	<i>Chrysanthemoïdes</i>
<i>Olea africana</i>	<i>monilifera</i>
<i>Rhus tomentosa</i>	<i>Zygophyllum morgsana</i>
<i>R. glauca</i>	<i>Nylandtia spinosa</i>
<i>Euclea racemosa</i>	<i>Putterlickia pyracantha</i>
<i>E. tomentosa</i>	<i>Diospyros glabra</i>
	<i>Pterocelastrus tricuspidatus</i>

with big bushy restiads, especially *Willdenowia striata*, and tall Fynbos species of semi-karroid form, e.g. *Eriocephalus racemosus*. The big shrubs are mainly confined to small mounds which are more widely scattered in the sandy parts than they are in the clayey parts. It is a complex and interesting veld type and justice cannot be done to it in a page or two, particularly as the Fynbos element in it is a complete Fynbos, with all the typical families and genera. Furthermore, the Fynbos of the limestone in the Bredasdorp division will have to be regarded as a distinct veld type, as will the dwarf Fynbos of the Elim flats, when a detailed survey comes to be made.

All stages in the conversion of the climax scrub forest and scrub into grassless Fynbos can be found; while along parts of the National Road from Mossel Bay westwards its reconversion as far as the grassveld stage has already taken place.

#### VI PURE GRASSVELD TYPES

These types occur on the upper plateau and the mountain tops at altitudes ranging from 1 050 over 3 050 m above the sea, in regions which are too dry and/or too frosty for the development of any kind of forest. Only on rocky hills, which are rare on the plains, and on the mountains, will a few scattered shrubs be found. Veld types 48-57 are tropical in affinity and are distinguished from one another mainly by the different proportions in which a handful of species occur. Veld types 58-60 are of mixed southern and tropical affinity, but the southern element has become dominant under prevailing conditions of veld management, i.e. to-day they are sharply distinct from the tropical types.



FIG. 80.—Coastal Macchia (47).  
Tufted *Thamnochortus erectus*  
in the foreground.

## 48 CYMBOPOGON-THEMEDA VELD

This (together with No. 56), is the veld of the sandy parts of the wetter higher lying portion of the highveld in the north-eastern Cape, Orange Free State and south-central Transvaal, undulating to flat country. Altitude ranges from 1 350-2 000 m above the sea, and rainfall from 450-750 mm per annum, falling in summer. Winters are severely frosty. Under these conditions, a mixed to sour grassveld is the climax; much of its has been ploughed up and the sandy soil is beginning to break down into sand.

Two variations can be recognized: (a) Southern variation in the Orange Free State and North-eastern Cape; (b) Northern variation in the Transvaal.

### (a) The Southern Variation of the Cymbopogon-Themedo Veld

This is a moderately dense grassveld (Fig. 81), rather short; species of general occurrence are:—

Themeda triandra...	307 067	Helichrysum	
Setaria flabellata...	205 783	rugulosum.....	17 685
Microchloa caffra...	150 538	Bracharia serrata	
Elionurus argenteus	126 650	var. serrata.....	9 545
Heteropogon		Cymbopogon	
contortus.....	125 485	plurinodis.....	9 145
Eragrostis		Harpochloa falx....	6 968
chloromelas.....	87 334	Hermannia	
E. racemosa.....	62 888	depressa.....	5 833
E. capensis.....	53 849	Eragrostis plana....	3 014
Tristachya hispida.	47 992		

Species of less general occurrence include:—

Digitaria		Hermannia	
tricholaenoides...	23 202	betonicifolia.....	556
Kyllinga sp.....	9 906	Felicia muricata....	537
Digitaria eriantha..	3 111	Aristida junciformis	491
D. monodactyla....	1 819	Helichrysum	
Trichoneura		dregeanum.....	369
grandiglumis.....	1 588	Vernonia	
Senecio erubescens.	724	oligocephala.....	310
Rhynchosia totta...	678	Aristida diffusa var.	
Anthospermum		burkei.....	165
rigidum.....	666	Andropogon	
		appendiculatus...	8 <sup>4</sup>

and many more, the total number of species in the Relative Abundance Table being 150. *Eragrostis chloromelas* and *Microchloa caffra* tend to increase with overgrazing, and sometimes *Harpochloa falx*; but this veld type maintains its density well.

In better samples of this veld type, *Aristida junciformis* is not of importance. There are parts, however, especially around Reitz, where it is becoming dominant on shallow soil which tends to become waterlogged and on rather steep old lands which were abandoned many years ago because erosion had made the soil too shallow. *Scirpus burkei* is conspicuous in such places.

The Karoo invasion is well under way in this region, patches of *Pentzia globosa* and *Felicia muricata* developing on the heavier soil along valleys and on eroded shaly hillsides, in the latter habitat usually accompanied by *Felicia filifolia*.

### (b) The Northern Variation of the Cymbopogon-Themedo Veld

This is a sparser, more tufted veld (Fig. 82). Altitude ranges from 1 300-1 500 m above the sea and rainfall from 500-700 mm per annum, falling in summer. Winters are frosty, as usual on the highveld.

Of general occurrence are:—

Setaria flabellata...	121 300	Vernonia	
Themeda triandra...	39 409	oligocephala.....	1 500
Heteropogon		Eragrostis	
contortus.....	26 816	gummiiflua.....	1 500
Eragrostis racemosa	20 096	Diheteropogon	
E. chloromelas....	19 780	amplectens.....	1 225
Elionurus argenteus	15 600	Eragrostis capensis	1 208
Cymbopogon		E. lehmanniana...	950
plurinodis.....	13 100	Setaria nigrirostris.	696
Bracharia serrata		Scabiosa	
var. serrata.....	12 480	columbaria.....	53
Eragrostis obtusa..	1 501	Eragrostis plana...	8
		Ziziphus zeyherana	6

Of less general occurrence are:—

Digitaria		Conyza pinnata....	832
argyrograpta....	4 688	Felicia filifolia....	832
Cynodon dactylon..	2 926	Panicum coloratum	800
C. incompletus....	2 880	Sporobolus	
Helichrysum		discosporus.....	464
rugulosum.....	1 000	Aristida congesta	
Anthospermum		subsp. congesta..	371
rigidum.....	832		

This veld type merges easily into the western variation of the Bankenveld. It needs more study.

FIG. 81.—Southern Variation of *Cymbopogon-Themed*a Veld (48a) south-west of Barkly East in the eastern Cape. Species at left: *Themeda triandra*, *Elionurus argenteus*, *Eragrostis capensis*, *E. chloromelas* and *E. curvula*. Species at right: *Chrysocoma tenuifolia*, *Pentzia cooperi*, *Walafrida saxatilis* and *Felicia muricata*.

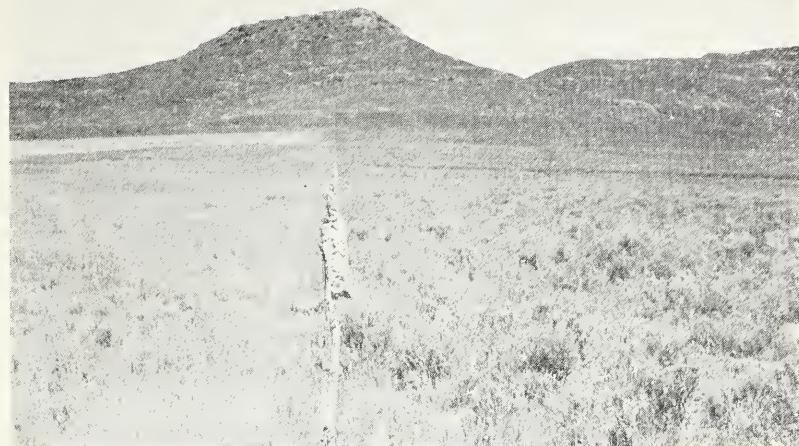


FIG. 82.—Northern Variation of *Cymbopogon-Themed*a Veld (48b) at Bethlehem in the eastern Orange Free State.

#### 49 TRANSITIONAL CYMBOPOGON-THEMEDA VELD

This veld type occupies drier country than the preceding type, receiving only 400-600 mm per annum, mostly 500 mm of rain per annum. It extends from the western edge of the *Cymbopogon-Themed*a Veld to the small escarpment that runs down the middle of the Orange Free State, in an irregular belt, deeply indented from the west by the drier valleys of tributaries of the Vaal River, and from the east by wetter and sandier ridges (Fig. 83). Were it not that most of the rock in this belt is dolerite, the vegetation would be *Cymbopogon-Themed*a Veld, but the heavy doleritic soil causes it rather to resemble the Turf Highland in being strongly dominated by *Themeda*; but the presence of such species as *Aristida congesta* subsp. *barbicollis*, *Panicum coloratum* and *Digitaria argyrograpta* and the absence of cultivation, show it to be, both actually and in effect, of a drier type; while the importance of *Eragrostis chloromelas* shows its relationship to the southern variations of the *Cymbopogon-Themed*a Veld and *Dry Cymbopogon-Themed*a Veld.

Species of general occurrence are:—

<i>Themeda triandra</i>	975	600	<i>Geigeria aspera</i>	1	879
<i>Eragrostis chloromelas</i>	246	960	<i>Kyllinga</i> sp.	1	700
<i>Oxalis depressa</i>	90	000	<i>Anthericum</i> sp.	1	670
<i>Microchloa caffra</i>	31	667	<i>Felicia muricata</i>	1	469
<i>Aristida congesta</i>			<i>Tragus racemosus</i>	1	204
subsp. <i>barbicollis</i>	29	140	<i>Crabbea acaulis</i>	1	123
<i>Sporobolus discosporus</i>	14	400	<i>Eragrostis lehmanniana</i>		991
<i>Panicum coloratum</i>	11	559	<i>Hermannia coccocarpa</i>		870
<i>Setaria flabellata</i>	11	010	<i>Walafrida densiflora</i>		837
<i>Digitaria argyrograpta</i>	8	626	<i>Chloris virgata</i>		639
<i>Cymbopogon plurinodis</i>	6	356	<i>Pentzia globosa</i>		572
<i>Gazania</i> sp.	5	667	<i>Cynodon incompletus</i>		408
<i>Tragus koelerioides</i>	5	200	<i>Indigofera alternans</i>		123
<i>Osteospermum scariosum</i>	4	837	<i>Herniaria erckertii</i>		
<i>Elionurus argenteus</i>	4	302	subsp. <i>erckertii</i>		
<i>Setaria nigrirostis</i>	3	837	var. <i>dewetii</i>		86
<i>Eragrostis obtusa</i>	2	502	<i>Hibiscus atomarginatus</i>		70
<i>Trachyandra aspera</i>			<i>Berkheyia</i> sp.		68
var. <i>natalglensa</i>	2	500	<i>B. onopordifolia</i>		57
<i>Helichrysum dregeanum</i>	2	310	<i>Eragrostis plana</i>		13
<i>Anthospermum rigidum</i>			<i>E. superba</i>		12
			<i>Scilla nervosa</i>		2
			<i>Talinum caffrum</i>		0,5



FIG. 83.—Transitional *Cymbopogon*-*Themeda* Veld (49) above Vals River Valley near Kroonstad in the Orange Free State.

There are few important species of less general occurrence, showing this to be a uniform veld type; they include:—

<i>Heteropogon</i>	<i>Cynodon dactylon</i> ..	756
<i>contortus</i> .....	2 002	578
<i>Oropetium</i> <i>capense</i>	2 000	558
<i>Cyperus</i>		
<i>semitrifidus</i> .....	1 111	

Overgrazing causes *Themeda* to be replaced by *Eragrostis chloromelas*, with little or no reduction in the cover. The total number of species in the Relative Abundance Table is 161.

Karoo invasion of this veld type is proceeding fast, taking two forms: (1) development of a mixed, grassy False Karoo in rocky places and along streams; (2) thickening up of already present plants of karroid form in eroded rocky places, particularly *Euryops empetrifolius*.

The small escarpment, which bounds this veld type on the west side has a fairly rich thornveld flora, in which the following species are important:—

<i>Acacia</i> <i>karroo</i>	<i>Ehretia</i> <i>rigida</i>
<i>Grewia</i> <i>occidentalis</i>	<i>Buddleia</i> <i>saligna</i>
<i>Celtis</i> <i>africana</i>	<i>Diospyros</i> <i>pallens</i>
<i>Olea</i> <i>africana</i>	<i>Euclea</i> <i>crispis</i> var. <i>crispis</i>
<i>Ziziphus</i> <i>mucronata</i>	<i>Cussonia</i> <i>spicata</i>
<i>Tarchonanthus</i>	<i>C. paniculata</i>
camphoratus var.	<i>Helinus</i> <i>integrifolius</i>
camphoratus	<i>Clutia</i> <i>pulchella</i>
<i>Rhus</i> <i>lancea</i>	<i>Heteromorpha</i> <i>arborescens</i>
<i>R. undulata</i> var. <i>tricrenata</i>	

and others, while besides the grassveld grasses, the following occur: *Aristida canescens*, *A. bipartita*, *A. diffusa* var. *burkei*, *Hyparrhenia hirta*, *Enneapogon scoparius*, *Rhynchelytrum repens*, *R. setifolium*, *Setaria nigrirostris*, *Bothriochloa radicans* and *Panicum maximum*.

## 50 THE DRY CYMBOPOGON-THEMEDA VELD

This veld type lies to the west and south of the Transitional *Cymbopogon*-*Themeda* Veld, at a lower elevation, and is drier. It has four variations: (a) Northern, north of the Vaal River on sandy soil. (b) Central, between the Vaal and Orange Rivers, as far south as Bloemfontein, mostly on sandy soil. (c) Southern, mostly on heavier soils, and distinguished by the presence of *Tetrachne dregei*, although this grass is now rare. (d) South-eastern, in the Upper White and Black Kei basin, mostly on sandy soils and lacking *Tetrachne*.

All four variations are dominated by *Themeda triandra* with *Cymbopogon plurinodis* the tallest grass, but usually not common; all are relatively sparse, especially the northern variation.

### (a) The Northern Variation of the Dry *Cymbopogon*-*Themeda* Veld (See Hutchinson, p. 414)

This lies at altitudes ranging from 1 300-1 350 m above the sea, flat, sandy country receiving a summer rainfall of 450-600 mm per annum, and has frosty winters (Fig. 84). Upwards it merges into the *Cymbopogon*-*Themeda* Veld, downwards into the bushveld and Kalahari Thornveld, with the appearance of stunted shrubs widely scattered in the open veld (mainly *Grewia flava* and *Diospyros pallens*), and bush on rocky outcrops.

Species of general occurrence are:—

<i>Themeda</i> <i>triandra</i>	165 050	<i>Hypoxis</i> <i>rooperi</i> .....	93
<i>Setaria</i> <i>flabellata</i> ..	142 282	<i>Lippia</i> <i>scaberrima</i>	87
<i>Cymbopogon</i>		<i>Eragrostis</i>	
<i>plurinodis</i> .....	37 350	<i>gummiflua</i> .....	84
<i>Eragrostis</i>		<i>Vernonia</i>	
<i>lehmanniana</i> .....	26 165	<i>oligocephala</i> .....	70
<i>Elionurus</i> <i>argenteus</i>	10 727	<i>Trichoneura</i>	
<i>Anthospermum</i>		<i>grandiglumis</i> ....	54
<i>rigidum</i> .....	7 625	<i>Barleria</i>	
<i>Heteropogon</i>		<i>macrostegia</i> .....	9
<i>contortus</i> .....	6 606	<i>Scilla</i> <i>nervosa</i> .....	9
<i>Eragrostis</i> <i>superba</i> ..	6 453	<i>Dicoma</i>	
<i>Eustachys</i> <i>mutica</i> ..	5 417	<i>macrocephala</i> ....	7
<i>Eragrostis</i>		<i>Sporobolus</i>	
<i>chloromelas</i> .....	5 347	<i>fimbriatus</i> .....	6
<i>Anthephora</i>		<i>Berkheyia</i>	
<i>pubescens</i> .....	5 318	<i>onopordifolia</i> ....	0,5
<i>Triraphis</i>			
<i>andropogonoides</i>	1 571		

Species of less general occurrence include:—

<i>Panicum</i> <i>coloratum</i>	19 577	<i>Bracharia</i> <i>serrata</i>	
<i>Cynodon</i> <i>dactylon</i>	6 075	var. <i>serrata</i> .....	56
<i>Digitaria</i> <i>eriantha</i> ..	5 625	<i>Aristida</i> <i>congesta</i>	
<i>D. argyrograpta</i> ...	2 720	subsp. <i>barbicollis</i>	50
<i>Stipagrostis</i>		<i>Cymbopogon</i>	
<i>uniplumis</i> .....	1 801	<i>excavatus</i> .....	49
<i>Felicia</i> <i>muricata</i> ....	473	<i>Helichrysum</i>	
<i>Aristida</i> <i>graciliflora</i>	273	<i>callicomum</i> .....	49
<i>A. diffusa</i> var.		<i>burkei</i> .....	
		113	

and many more, the number of species in the Relative Abundance Table being 140.

### (b) The Central Variation of the Dry *Cymbopogon*-*Themeda* Veld (See Adamson, Photo 13)

This occupies very flat country at altitudes ranging from 1 300-1 350 m above sea-level and receiving a summer rainfall of 450-500 mm per annum (Fig. 85). Turfy parts are transitional both to the transitional *Cymbopogon*-*Themeda* Veld and the Pan Turf Veld; the sandier parts, which are more general, are transitional rather to the Kalahari Thornveld.

Species of general occurrence are:—

<i>Themeda</i> <i>triandra</i> ..	310 874	<i>contortus</i> .....	11 929
<i>Aristida</i> <i>congesta</i>		<i>Digitaria</i>	
subsp. <i>congesta</i> ..	58 652	<i>argyrograpta</i> ....	7 929
<i>Eragrostis</i>		<i>Polygontria</i>	
<i>lehmanniana</i> .....	53 188	<i>squarroso</i> .....	5 475
<i>E. superba</i> .....	45 163	<i>Eragrostis</i>	
<i>Cynodon</i> <i>dactylon</i>	41 237	<i>tricophora</i> .....	3 645
<i>Setaria</i> <i>flabellata</i> ..	41 077	<i>Stachys</i> <i>spathulata</i> ..	3 611
<i>Tragus</i> <i>koelerioides</i>	38 254	<i>Euphorbia</i>	
<i>Elionurus</i> <i>argenteus</i>	29 003	<i>inaequilatera</i> ....	1 859
<i>Anthephora</i>		<i>Triraphis</i>	
<i>pubescens</i> .....	24 102	<i>andropogonoides</i>	1 716
<i>Cymbopogon</i>		<i>Anthospermum</i>	
<i>plurinodis</i> .....	19 533	<i>rigidum</i> .....	653
<i>Eragrostis</i>		<i>Dicoma</i>	
<i>chloromelas</i> .....	15 574	<i>macrocephala</i> ....	10

FIG. 84.—Northern Variation (50a) of Dry *Cymbopogon-Themedo* Veld near Kingsmead in the south-west Transvaal. Normal constituents are *Themeda triandra*, *Setaria flabellata* followed by *Cymbopogon plurinodis*, *Eragrostis lehmanniana* and *Elionurus argenteus*.



FIG. 85.—Central Variation (50b) of Dry *Cymbopogon-Themedo* Veld near Dealesville in the western Orange Free State. Mainly *Eragrostis lehmanniana* and *Sporobolus iocladius* with patches of *Themeda triandra* visible beyond bare patch. The shrubs are mostly *Pentzia globosa* and *Chrysocoma tenuifolia*.

#### Species of less general occurrence include:—

<i>Aristida congesta</i>		<i>Stipagrostis</i>	
subsp. <i>barbicollis</i>	12 680	<i>uniplumis</i> .....	492
<i>A. graciliflora</i> .....	3 828	<i>Commelinia</i>	
<i>Panicum coloratum</i>	1 257	<i>africana</i> .....	417
<i>Eragrostis obtusa</i> ..	819	<i>Aptosimum</i>	
<i>Trichomeura</i>		<i>depressum</i> .....	392
<sub>grandiglumis</sub> ....	758	<i>Felicia muricata</i> ....	298

and many more, the number of species in the Relative Abundance Table being 231.

As has been pointed out (p. 8), there are signs of thorn and Karoo invasion in both of these variations of the Dry *Cymbopogon-Themedo* Veld, though at present small and localized. The importance of *Aristida congesta*, subsp. *congesta*, *Eragrostis lehmanniana* and *Tragus koelerioides* shows the more arid nature of this veld.

#### (c) The Southern Variation of the Dry *Cymbopogon-Themedo* Veld

This was formerly by far the most extensive of the variations of the Dry *Cymbopogon-Themedo* Veld, being the sweet grass veld that has so largely been invaded by Karoo to form the False Karoo. It

was a particularly valuable sheep veld in having *Tetrachne dregei*, a broad-leaved evergreen grass forming stools up to 1 m in diameter. The special value of this veld type has been destroyed, thrown away along with the soil and it is very doubtful if it can be fully restored.

Altitudes range from 1 200-1 500 m above the sea, and rainfall from 450-500 mm per annum in the surviving parts of it, though relics occur in areas receiving as little as 300 mm. The rainy season is in late summer.

#### Species of general occurrence are:—

<i>Themeda triandra</i> ..	301 254	<i>Helichrysum</i>	
<i>Tragus koelerioides</i>	79 185	<i>dregeanum</i> .....	17 954
<i>Eragrostis</i>		<i>Eragrostis obtusa</i> ..	1 493
<sub>chloromelas</sub> ....	56 509	<i>Sporobolus</i>	
<i>Digitaria</i>		<i>fimbriatus</i> .....	1 001
<sub>argyrograpta</sub> ....	43 648	<i>Felicia muricata</i> ..	179
<i>Cymbopogon</i>		<i>Walafrida saxatilis</i>	133
<sub>plurinodis</sub> ....	39 931	<i>Pentzia globosa</i> ....	73
<i>Eragrostis</i>		<i>Chrysocoma</i>	
<sub>lehmanniana</sub> ....	37 822	<i>tenuifolia</i> .....	70

The poisonous *Moraea polystachya*, *Homeria pura* and *Gynandriris simulans* are generally abundant in depressions.

Species of less general occurrence include:—

Cyperus usitatus...	19 570	Aristida	
Ifloga paronychioides...	6 545	adscensionis....	909
Aristida congesta subsp. congesta...	6 188	Eragrostis curvula.	536
Elionurus argenteus	3 223	Indigofera alternans	506
Osteospermum scariosum.....	1 992	Aristida diffusa var. burkei.....	431
Heteropogon contortus.....	1 924	Triraphis andropogonoides	345
Sporobolus discosporus.....	1 013	Panicum staphianum.....	332
		Eragrostis bicolor..	300

and many more, the number of species in the Relative Abundance Table being 168.

#### (d) The South-eastern Variation of the Dry Cymbopogon-Themededa Veld

Little information is available about this variation, but, in lacking *Tetrachne*, it is closer to the Central Variation than to the southern. Parts of it, at least, are distinguished by having *Eustachys mutica* among the abundant grasses. It has suffered considerably through drought in recent years, and is being invaded by *Acacia karroo*.

#### 51 PAN TURF VELD

This is the veld of the turf soil on the flats around the pans of the western part of the Orange Free State. It is a very dense *Themeda* veld, but little is left in that condition (Fig. 86). Under conditions of overgrazing, *Eragrostis obtusa*, as well as *E. chloromelas*, tend to replace *Themeda*, and it is readily invaded by Karoo.

The principal species are:—

Themeda triandra	E. micrantha
Panicum coloratum	Setaria woodii
Eragrostis chloromelas	Sporobolus fimbriatus
E. obtusa	Digitaria argyrograpta
E. plana	

In the wetter, low-lying parts, *Echinochloa holubii*, *Sporobolus tenellus*, S. sp. = A. 13532, *Platycarpha parvifolia*, *Diplachne fusca*, *Panicum laevifolium*, *Scirpus* spp. and *Eragrostis bicolor* are abundant.

#### 52 THEMEDA VELD OR TURF HIGHVELD

Occurring on black turf, this is an extremely dense *Themeda* veld, with no other species playing an important part (Figs. 87 and 88). Most of it, where the soil is deep enough, is ploughed up. Elevation ranges from 1 500-1 750 m above the sea, and rainfall from 650-750 mm per annum, falling in summer.

Species of general occurrence are:—

Themeda triandra.....	1 062 240	Cymbopogon plurinodis.....	6 521
Heteropogon contortus.....	79 552	Eragrostis chloromelas.....	4 317
Eragrostis racemosa	51 236	E. plana.....	3 180
Tristachya hispida.	49 009	E. capensis.....	2 811
Elionurus argenteus	27 111	Anthospermum rigidum.....	1 995
Setaria nigrigrostris	14 985	Bracharia serrata.....	1 072
Bracharia serrata var. serrata.....	7 378	Digitaria diagonalis	

Species of less general occurrence include:—

Setaria flabellata...	40 223	Vernonia oligocephala....	225
Trichopogon spicatus.....	6 756	Geigeria aspera....	198
Aristida bipartita...	2 137	Haplocarpha scaposa.....	12
Microchloa caffra...	1 956	Cymbopogon excavatus.....	5
Berkheyia rigida....	556	Helichrysum rugulosum.....	
	300		

and others, the number of species in the Relative Abundance Table being 78.

This veld extends along watercourses far into the surrounding veld types. The poisonous *Geigeria aspera* is a potential danger.

#### 53 PATCHY HIGHVELD TO CYMBOPOGON-THEMEDA VELD TRANSITION

This is not, strictly speaking, a veld type at all, but merely a maze of patches of Turf Highveld on turf soil, of *Cymbopogon-Themededa Veld* on sandy soil, with outliers of Bankenveld on rocky outcrops along its northern margin (Fig. 89). It is not such flat country as most of the highveld, undulating across the valleys of the Wilge River and various sprouts draining into the Orange River.



FIG. 86.—Pan Turf Veld (51) near Wesselsbron in the northern Orange Free State. Species present: *Themeda triandra* and *Echinochloa holubii*.

FIG. 87.—*Themeda* Veld or Turf Highveld (52) near Standerton in the Transvaal. *Themeda triandra* is dominant with *Cymbopogon plurinodis* conspicuous. The abundance of *Geigeria* indicates that grazing pressure is too great.



FIG. 88.—Effect of drought on the black turf of Turf Highveld (52) in the Golugola Plain near Kingsley in northern Natal. Present: *Paspalum notatum* with tufts of *Eragrostis plana*, but generally *Themeda triandra* is overwhelmingly dominant.



FIG. 89.—Patchy Highveld to Cymbopogon-Themedá Veld Transition (53) near Vrede in the north-eastern Orange Free State. Short-grazed *Themeda*—Veld below dolerite ridge with tufts of *Eragrostis plana* left ungrazed.

**54 TURF HIGHVELD TO HIGHLAND SOURVELD TRANSITION**

This veld type, lying mostly between 1 700 and 1 850 m above the sea, and receiving a rainfall of about 750 mm per annum, links veld type 52 with the Highland Sourveld and North-Eastern Sandy Highveld. It is not so completely dominated by *Themeda* as is the Turf Highveld, is more mixed, denser and sourer.

Species of general occurrence are:—

<i>Themeda triandra</i> ..	727 200	<i>Digitaria</i>	
<i>Heteropogon contortus</i> .....	331 900	monodactyla....	5 196
<i>Tristachya hispida</i> ..	284 400	appendiculatus...	4 862
<i>Harpochloa falx</i> ....	69 486	<i>Bracharia serrata</i>	
<i>Digitaria tricholaenoides</i> ...	49 278	var. <i>serrata</i> ....	4 725
<i>Setaria flabellata</i> ...	44 894	<i>Eragrostis plana</i> ...	2 517
<i>Eliorinus argenteus</i>	39 750	<i>Diheteropogon amplectens</i> .....	1 875
<i>Eragrostis racemosa</i>	27 938	<i>Cymbopogon plurinodis</i> .....	1 252
<i>Microchloa caffra</i> ..	10 075	<i>Andropogon schirensis</i> .....	655
<i>Eragrostis capensis</i>	5 625	<i>Aristida junciformis</i>	501
<i>Helichrysum rugulosum</i> .....	5 519		
<i>Eragrostis chloromelas</i> .....	5 370		

i.e. a good transitional type. The only species of importance that is not of general occurrence is *Trachypogon spicatus* 19 577, showing this to be a uniform veld type. Scrub forests of *Leucosidea sericea* occur on mountain sides at its upper margin.

The total number of species in the Relative Abundance Table is 80, but no mountain sides were included in the samples.

**55 BANKENVELD TO TURF-HIGHVELD TRANSITION**

Besides the area mapped as this veld type, there are smaller patches along the northern edge of the Turn Highveld. It is a *Themeda* dominated veld, but includes some of the sourer grasses in important quantities, e.g. *Trachypogon spicatus*, *Mono-cymbium ceresiiforme*, *Andropogon* spp., *Aristida junciformis* and *Tristachya hispida*. Little information is available about it.

**56 HIGHLAND SOURVELD TO CYMBOPOGON-THEMEDA VELD TRANSITION**

(See Taljaard, Photos 64, 65, 67)

This veld type links the *Cymbopogon-Themed*a veld with the Highland Sourveld in the highest and wettest part of the Orange Free State, at altitudes ranging from 1 500-2 000 m above the sea and under a rainfall of 650-1 000 mm per annum. Soils are sandy. An important outlier of it, at 1 200-1 700 m above the sea, occurs on the Cedarville Flats and in other fairly flat, sandy country around Mount Fletcher, Matatiele and Kokstad, with a smaller outlier near Volksrust and other too small to map. It is a good transitional type, having *Cymbopogon* and *Eragrostis capensis* of the *Cymbopogon-Themed*a Veld with many of the sour grasses of the Highland Sourveld, and *Themeda* is only co-dominant with *Tristachya hispida* (Fig. 90). This importance of *Tristachya* suggests an affinity with the North-Eastern Sandy Highveld and other more northern veld types.

Species of general occurrence are:—

<i>Themeda triandra</i> ..	367 760	<i>Helichrysum rugulosum</i> .....	1 464
<i>Tristachya hispida</i> ..	367 760	<i>Cyperus obtusiflorus</i> var. ..	1 024
<i>Eliorinus argenteus</i>	143 560	<i>Vernonia oligocephala</i> ....	1 022
<i>Eragrostis racemosa</i>	133 080	<i>Ajuga ophrydis</i> ....	840
<i>Digitaria tricholaenoides</i> ...	117 840	<i>Haplocarpha scaposa</i> .....	572
<i>Heteropogon contortus</i> .....	72 685	<i>Hermannia depressa</i> .....	562
<i>Harpochloa falx</i> ....	63 708	<i>Anthospermum rigidum</i> .....	560
<i>Digitaria monodactyla</i> ....	15 539	<i>Ipomoea crassipes</i> ..	504
<i>Microchloa caffra</i> ..	13 552	<i>Gnida kraussiana</i> ..	211
<i>Trachypogon spicatus</i> .....	8 928	<i>Rhynchosia totta</i> ...	64
<i>Bracharia serrata</i>		<i>Walafrida densiflora</i> .....	56
var. <i>serrata</i> ....	8 854	<i>Indigofera rostrata</i> .	51
<i>Eragrostis capensis</i>	8 643	<i>Senecio coronatus</i> ..	45
<i>E. chloromelas</i> ....	6 497	<i>S. erubescens</i> .....	45
<i>Kohautia amatymbica</i> ....	4 863	<i>Sonchus nanus</i> ....	45
<i>Andropogon schirensis</i> .....	3 400	<i>Asclepias multicaulis</i> ....	22
<i>Hypoxis rigidula</i> ..	3 318	<i>Euphorbia striata</i> ..	9
<i>Cymbopogon plurinodis</i> .....	2 489		
<i>Helichrysum latifolium</i> .....	1 676		



FIG. 90.—Turf Highveld to Highland Sourveld Transition (56) near Aberfeldy in the south-eastern Orange Free State. Present: *Themeda triandra*, *Tristachya hispida*, *Eliorinus argenteus*, *Digitaria tricholaenoides* becoming unduly common.

Species of less general occurrence include:—

<i>Setaria flabellata</i> ...	3 680	<i>Lotononis calycina</i>	300
<i>Aristida congesta</i>		<i>Tolpis capensis</i> ....	35
subsp. <i>congesta</i> ...	1 442	<i>Hermannia</i>	
		<i>betonicifolia</i> ....	34
<i>Andropogon</i>		<i>Eragrostis plana</i> ...	31
<i>appendiculatus</i> ....	1 254	<i>Pentanisia</i>	
<i>Aristida junciformis</i>	440	<i>prunelloides</i> ....	20
<i>Fimbristylis</i>		<i>Ipomoea crassipes</i>	4
<i>monostachya</i> ....	419	<i>Scabiosa</i>	
<i>Gazania</i> spp. ....	313	<i>columbaria</i> ....	4
<i>Helichrysum</i>		<i>Boophane disticha</i>	0,2
<i>nudifolium</i> ....	313		
<i>Aristida diffusa</i> var.			
<i>burkei</i> .....	302		

and many more, the number of species in the Relative Abundance Table being 160.

This region, especially in the Orange Free State, is not so flat as that occupied by the *Cymbopogon-Themedo* Veld, being more rolling and broken. The rock is mainly sandstone. On the rocky slopes patches of bush, sometimes almost scrub forest, occur; the principal species include:—

<i>Celtis africana</i>		<i>Euclea crispa</i> var. <i>crispa</i>	
<i>Olea africana</i>		<i>Diospyros austro-africana</i>	
<i>Kiggelaria africana</i>		var. <i>austro-africana</i>	
<i>Myrsine africana</i>		<i>Maytenus heterophylla</i>	
<i>Rhus erosa</i>		<i>Clutia pulchella</i>	
<i>R. dentata</i> var. <i>grandifolia</i>		<i>Rhoicissus tridentata</i>	
<i>R. macowanii</i>		<i>Grewia occidentalis</i>	
<i>R. divaricata</i>		<i>Halleria lucida</i>	
<i>Buddleia salviifolia</i>		<i>Rubus ludwigii</i> and others	
<i>Rhamnus prinoides</i>			

with *Leucosidea sericea* becoming important at higher levels.

Similar bush occurs down the eastern side of the *Cymbopogon-Themedo* Veld.

## 57 NORTH-EASTERN SANDY HIGHLAND

This corresponds to the *Cymbopogon-Themedo* Veld to Highland Sourveld transition and the Highland Sourveld southwards, but has a strong Bankenveld affinity. Altitude ranges from 1 600—2 150 m above the sea and rainfall ranges from 750—950 mm per annum, falling in summer. It has two variations: (a) Near-Bankenveld, occurring mainly on the western side of the low watershed which here represents the Drakensberg. (b) Near Highland Sourveld, mainly on the top and eastern side of the watershed.

### (a) Near-Bankenveld Variation of the North-eastern Sandy Highveld

The species of general occurrence are:—

<i>Tristachya hispida</i> ...	518 850	<i>Allotropis</i>	
<i>Trachypogon</i>		<i>semialata</i> .....	9 288
<i>spicatus</i> .....	272 056	<i>Panicum natalense</i> ..	9 284
<i>Themedo triandra</i> ...	256 978	<i>Helichrysum</i>	
<i>Heteropogon</i>		<i>oreophilum</i> ....	5 639
<i>contortus</i> ....	193 733	<i>Brachiaria serrata</i>	
<i>Eragrostis racemosa</i>	155 227	var. <i>serrata</i> ....	4 314
<i>Digitaria</i>		<i>Ctenium</i>	
<i>tricholaenoides</i> ...	113 883	<i>concinnum</i> ....	4 080
<i>Monocymbium</i>		<i>Eragrostis plana</i> ....	3 105
<i>ceresiiforme</i> ....	47 690	<i>Diheteropogon</i>	
<i>Microchloa caffra</i> ...	40 547	<i>amplectens</i> ....	2 041
<i>Loudetia simplex</i> ...	32 361	<i>Harpochloa falx</i> ....	1 607
<i>Andropogon</i>		<i>Eragrostis</i>	
<i>schirensis</i> ....	23 898	<i>sclerantha</i> ....	1 135
<i>Elionurus argenteus</i>	10 063		

Of less general occurrence are:—

<i>Rendlia altera</i> ....	21 602	<i>pectinatus</i> ....	1 152
<i>Tristachya</i>		<i>Dicoma anomala</i> ...	834
<i>rehmannii</i> ....	2 425	<i>Schizachyrium</i>	
<i>Diheteropogon</i>		<i>sanguineum</i> ....	602
<i>filifolius</i> ....	1 629	<i>Panicum eklonii</i> ...	407
<i>Aristida</i>		<i>Eragrostis</i>	
<i>aequiglumis</i> ....	1 472	<i>patentissima</i> ....	310
<i>A. junciformis</i> ....	1 238		

and many more, the total number of species in the Relative Abundance Table being 103.

So *Themedo* is not dominant in this veld type, its place being taken by southerly species; the veld, however, is dense. In winter it acquires the grey, dead look of Bankenveld, lacking the purplish colour of *Themedo* as dominant.

### (b) Near-Highland Sourveld Variation of the North-eastern Sandy Highveld

In this case, *Themedo* is the dominant, although the list of species is much the same as in the other variation, and the veld is just as dense (Fig. 91).

The species of general occurrence are:—

<i>Themedo triandra</i> ...	500 251	<i>Monocymbium</i>	
<i>Tristachya hispida</i> ...	456 693	<i>ceresiiforme</i> .....	14 479
<i>Digitaria</i>		<i>Andropogon</i>	
<i>tricholaenoides</i> ...	211 911	<i>schirensis</i> .....	10 057
<i>Heteropogon</i>		<i>Elionurus</i>	
<i>contortus</i> ....	180 400	<i>argenteus</i>	8 928
<i>Eragrostis racemosa</i>	148 880	<i>Brachiaria</i>	
<i>Trachypogon</i>		<i>serrata</i> .....	6 625
<i>spicatus</i> ....	83 264	<i>Allotropis</i>	
<i>Microchloa caffra</i> ...	75 129	<i>semialata</i> .....	6 229
<i>Andropogon</i>		<i>Aristida</i>	
<i>appendiculatus</i> ....	26 127	<i>junciformis</i>	4 247
<i>Rendlia altera</i> ....	21 250	<i>Harpochloa</i>	
		<i>falx</i> ....	3 854
		<i>Helichrysum</i>	
		<i>rugulosum</i> .....	1 682

Of less general occurrence are:—

<i>Loudetia simplex</i> ...	10 371	<i>Euryops</i>	
<i>Diheteropogon</i>		<i>transvaalensis</i>	
<i>filifolius</i> .....	5 568	subsp. <i>setilobus</i> ..	711
<i>Eragrostis</i>		<i>Anthospermum</i>	
<i>chloromelas</i> ....	3 486	<i>rigidum</i> .....	668
<i>Bulbostylis</i> sp. ....	3 250	<i>Berkheya setifera</i> ...	465
<i>Setaria nigrirostris</i> ...	2 233	<i>Ctenium</i>	
<i>Eragrostis capensis</i>	2 169	<i>conicum</i> .....	45
<i>E. plana</i> .....	1 333	<i>Diheteropogon</i>	
<i>amplectens</i> ....	890	<i>amplectens</i> ....	

and many more, the number of species in the Relative Abundance Table being 118.

## 58 THEMEDA-FESTUCA ALPINE VELD

This is the veld of the Drakensberg above 1 850—2 150 m, receiving a rainfall ranging from 600 to over 1 900 mm per annum on the highest points, so that a good deal of variation is to be expected. There is, nevertheless, a remarkable degree of uniformity all along the mountains from about Naudes Nek Pass along the Drakensberg, Stormberg, Bamboesberg, Suurberg, Kikvorschberg and Sneeuberg to the eastern part of the Nieuwveld Range, suggesting that other factors than total rainfall are important in controlling the nature of the vegetation on these mountains (Figs. 92 and 93).

It is a short, dense grassveld, varying from sweet to mixed, dominated by *Themedo triandra* with an admixture of the usual grassveld species, e.g.:—

<i>Elionurus argenteus</i>		<i>Andropogon appendiculatus</i>	
<i>Heteropogon contortus</i>		<i>Trachypogon spicatus</i>	
<i>Eragrostis chloromelas</i>		<i>Cymbopogon marginatus</i>	
<i>E. racemosa</i>		<i>Harpochloa falx</i>	
<i>E. capensis</i>		<i>Aristida diffusa</i> var. <i>burkei</i>	
<i>E. curvula</i>			
<i>Microchloa caffra</i>			

but it has, also, a high proportion of grasses of less usual occurrence (many being of southern affinity), especially at higher altitudes, e.g.:—

<i>Festuca costata</i>		<i>Setaria sphacelata</i>	
<i>F. scabra</i>		<i>Pentaschistis microphylla</i>	
<i>F. caprina</i> and others		<i>P. natalensis</i> and others	
<i>Merxmuellera disticha</i>		<i>Brachiaria serrata</i> var. <i>gossypina</i>	
<i>Karrochloa purpurea</i>		<i>Koeleria cristata</i>	
<i>Merxmuellera macowanii</i>		<i>Poa binata</i>	
and others		<i>Bromus firmior</i> and others	
<i>Helictotrichon hirtulum</i>			
<i>Tetrachne dregei</i>			



FIG. 91.—Near Highland Sourveld (57b) above Roos Senekal in the Transvaal. Species noted: *Tristachya hispida*, *Trachypogon spicatus*, *Loudetia simplex*, *Dilectropogon filifolius*, *Sporobolus pectinatus*, *Rendalia altera* and *Heteropogon contortus*.



FIG. 92.—*Themeda-Festuca* Alpine Veld at the edge of the Drakensberg escarpment between Cleft Peak and Mont aux Sources. *Erica-Helichrysum* Heath in the foreground.



FIG. 93.—*Themeda-Festuca* Alpine Veld (58) in the Mokhotlong River Valley in eastern Lesotho.

There was, and sometimes still is, scrub forest in sheltered kloofs, in which *Leucosidea sericea* is the dominant, along with:—

Buddleia salviifolia	Clutia pulchella
Polemannia grossulariaeefolia	Olea africana
Rhamnus prinoides	Rhus lucida
Myrsine africana	Celtis africana
Erica caffra	Buddleia corrugata
	Arundinaria tesselata

and others.

The soil is generally of a black, turf-like nature, derived from the Drakensberg basalt, even on the cave sandstone below, and is very erodible. *Merxmuellera disticha* becomes dominant, especially on shallow soil and on rocky outcrops; but the main effect of mismanagement is to convert this veld into a Karroid False Fynbos; i.e., in either case mismanagement encourages the southern element of the flora. A form of Fynbos is a natural part of this vegetation, especially on the eastern side of the Drakensberg, but, although species of this Fynbos may spread, the present development is mainly on the western side of the mountains and is an invasion of the karroid form of near-Fynbos that we find all along the tops of the Karoo mountain ranges. The natural Fynbos relics consist of *Passerina montana*, *Erica woodii*, *E. drakensbergensis*, *E. ebracteata*, *E. thodei*, *Phyllica paniculata*, *Cliffortia nitidula* subsp. *pilosa* and others, often with *Encephalartos ghellinckii* and *Widdringtonia nodiflora* and with a high proportion of species belonging to the forest margin; but in the Karroid False Fynbos, few of these typically Fynbos species occur, except *Passerina montana* and *Erica caffra*. Besides these two, important species in the Karroid False Fynbos are:—

Chrysocoma tenuifolia	Diospyros austro-africana
Felicia filifolia	var. austro-africana
Euryops tenuissimus	Nestlera acerosa
E. oligoglossus	Eriocephalus punctulatus
racemosus	Felicia petiolata
E. candollei	Cliffortia ramosissima
E. floribundus	Clutia pulchella
Pentzia cooperi	Selago speciosa
Walafrida saxatilis	Artemisia afra w
Heichrysum splendidum	Indigofera spinescens
Sutera pristisepala	Stoebe vulgaris
Rhus erosa	Metalasia muricata
	Relhania pungens

and others.

A curious sight in this veld is *Euphorbia mauritanica* growing under *Leucosidea sericea*. The presence of *Aloe ferox* on northern aspects in the Telle Drift area illustrates how elements of the eastern coastal flora could have migrated along the mountains of the north-east Cape into the Orange River valley at a time when conditions were warmer than they are now.

## 59 STORMBERG PLATEAU SWEETVELD

This veld type is transitional from the preceding to the Karroid *Merxmuellera* Mountain Veld; it differs mainly in occupying a plateau instead of steep-sided mountains, on rocks (of the Molteno series) which readily weather into a deep soil. At altitudes ranging from 1 500-2 000 m, and under a rainfall of 500-650 mm, we find a sweet grassveld developed, which much resembles the vlei vegetation of these other two veld types. In general it is a *Themeda*-dominated veld on a black, peaty soil; it tends to become sourer when selectively grazed, with an increase in *Elionurus argenteus* (Fig. 94). It includes a high proportion of:—

Pennisetum sphacelatum	Koeleria cristata
Tetrachne dregei	Pentaschistis microphylla
Festuca scabra	Helictotrichon hirtulum
Eragrostis chloromelas	Ehrharta sp.
E. curvula	Digitaria sp.
E. capensis	Harpochloa falx
Karroocholoa purpurea	

with *Merxmuellera disticha*, *Aristida diffusa* var. *burkei* and *Cymbopogon plurinodis* dominant on rocky sandstone outcrops, but *Themeda* completely dominant on dolerite outcrops. A feature of this plateau is the extensive vleis, which are dominated by *Tetrachne*, with *Festuca scabra*, *Fingerhuthia seleriformis*, *Eragrostis chloromelas* and some *Themeda*, and extremely dense, deep veld. In tramped out veld, *Karroocholoa purpurea*, *Pentaschistis microphylla* and other small grasses become important.

The hills are being invaded by Karroid False Fynbos, in which *Felicia filifolia* is sometimes conspicuous.

Small outliers of this veld type appear to occur on the Suurberg plateau, but are very badly tramped out and invaded by Karoo.



FIG. 94.—Stormberg Plateau Sweetveld (59) near Wodehouse in the Cape. Originally *Themeda triandra*, *Tetrachne dregei*, *Pennisetum sphacelatum* and *Festuca scabra*, but here breaking down to *Aristida diffusa* var. *burkei*, *Elionurus argenteus* and *Eragrostis chloromelas*.

## 60 KARROID MERXMUELLERA MOUNTAIN VELD

Starting in the east as patches on rocky, dry aspects in the *Festuca-Themedea* Alpine Veld and Stormberg Plateau Sweetveld, this veld type (Fig. 95) covers all the higher mountains of the False Karoo and Central Upper Karoo, as far west as the Beaufort West division, where *Merxmuellera disticha*\* is replaced by *Merxmuellera stricta*\* and the veld of the remainder of the mountain tops, to the Hantamsberg and Kamiesberg, is what has been separated as Mountain Rhenosterbosveld. Mountain Rhenosterbosveld, however, is closely related to the Karroid *Merxmuellera* Mountain Veld. The latter also covers the inland slopes of the Winterberg and Katberg to the neighbourhood of Cathcart.

The dominant grass all through is *Merxmuellera disticha*, and although it may be the natural dominant in rocky sandstone parts, it is probable that in all dolerite parts and all parts covered with soil, *Themedea* and *Tetrachne* are the natural dominants, together with such species as:—

<i>Ehrharta calycina</i>	P. sp. (= A. 11960)
<i>Eragrostis chloromelas</i>	<i>Karroocholoa curva</i>
<i>Melica decumbens</i>	<i>Fingerhuthia sesleriiformis</i>
<i>Festuca scabra</i>	W
<i>Karroocholoa purpurea</i>	<i>Koeleria cristata</i>
<i>Merxmuellera stricta</i>	<i>Brachypodium</i> sp. = A. 16165
<i>Helictotrichon hirtulum</i>	<i>Bromus leptoclados</i>
<i>H. turgidulum</i>	<i>Cymbopogon prolixus</i>
<i>Pentaschistis</i> sp. = A. 15700	<i>Bromus willdenowii</i>
<i>Eustachys mutica</i>	

with a variety of non-grasses, e.g.:—

<i>Diascia capsularis</i>	<i>Pelargonium ramosissimum</i>
<i>Sutera macrospiphon</i>	<i>Cheilanthes eckloniana</i>
<i>Dianthus caespitosus</i> subsp. caespitosus	<i>Cheilanthes hirta</i>
<i>Othonna auriculaefolia</i>	<i>Stachys aethiopica</i>
<i>Urtica dioica</i> w	<i>Chenopodiumstellatum</i>
<i>Ficinia</i> sp. (= A. 15994)	<i>Senecio othonniformis</i>
F. sp. (= A. 16157)	<i>Delosperma</i> sp. (= A. 16279)
<i>Pelargonium aridum</i>	<i>Euphorbia epicyparissias</i>
<i>P. dichondraefolium</i>	<i>Melolobium</i> sp. (= A. 15989)
<i>Schoenoxiphium</i> sp. (= A. 15990)	

and many more.

In the wetter parts, e.g. Zwagershoek Pass and the Winterberg, grasses like *Elionurus argenteus*, *Festuca costata*, *Heteropogon contortus*, *Bromus*

*firmior*, *Pennisetum sphacelatum*, *Eragrostis racemosa* and *Pentaschistis* sp. suggest a transition to *Festuca-Themedea* Mountain Veld and Dohne Sourveld. Southern aspects in this veld have traces of scrub forest and Fynbos, but the transition to the *Aristida diffusa*-dominated open mountain scrub of the Karroid Broken Veld is so easy that there is no clear dividing line. The scrub species are the same as in the Karroid Broken Veld scrub, but the Fynbos is sometimes surprisingly complete, though it lacks such important groups as *Proteaceae* and *Rutaceae*, e.g. on the Bamboesberg. Species of definitely Fynbos affinity occurring here and growing densely are:—

<i>Elytropappus rhinocerotis</i>	<i>Philippia</i> sp.
<i>Erica caffra</i>	<i>Muraltia macroceras</i>
<i>Cliffuria ramosissima</i>	<i>Passerina montana</i>
C. sp. = A. 15906	<i>Eumorphia dregeana</i>
<i>C. tuberculata</i>	<i>E. corymbosa</i>
<i>Tetraaria</i> sp. cf. T. macowanii	<i>Pentzia cooperi</i>
<i>Ficinia</i> sp. = A. 15900	<i>Pelargonium quercifolium</i>
<i>Metalaenia muricata</i>	<i>P. multicaule</i>
<i>Ursinia montana</i> subsp. apiculata	<i>Anthospermum</i> sp. = A. 15844
<i>Restio</i> sp.	<i>Clutia polifolia</i>

but, as a rule, these (with the exception of *Elytropappus* sometimes dominant, *Eumorphia dregeana* and *Anthospermum*) are scarce, the more karroid species being dominant, e.g.:—

<i>Chrysocoma tenuifolia</i>	<i>Felicia filifolia</i>
<i>Euryops oligoglossus</i>	<i>Helichrysum trilineatum</i> (eastwards)
<i>Helichrysum hamulosum</i>	<i>H. niveum</i>
<i>Eriocaulus punctulatus</i>	<i>Walafrida saxatilis</i>
<i>E. eximius</i>	<i>Melolobium</i> spp.
<i>Dimorphotheca cuneata</i>	<i>Nestlera prostrata</i>

Where areas of bare rock, especially dolerite, are exposed in this veld, even on the mountain tops, a sparser, semi-succulent vegetation is found. The principal succulents are at least four species of bushy *Ruschia* (not yet found in flower), with *Sarcocaulon patersonii*, *Adromischus nanus*, *A. maculatus*, *Aloe striatula*, *A. broomii*, *Delosperma* sp., *Anacamptos ustulata*, *A. telephium*, *Ruschia indurata*, *Stomatium peersii*, *Chasmophyllum musculinum*, *Cotyledon* sp., *Euphorbia rectirama*, *E. aggregata*, *Crassula corallina* and other small *Crassula* spp.



FIG. 95.—Karroid *Merxmuellera* Mountain Veld (60) at Bergplaas on the Great Winterberg in the Cape. Species present: *Merxmuellera disticha*, *Themedea triandra*, *Eragrostis curvula*, *Chrysocoma tenuifolia* and *Diospyros austro-africana*.

\* Formerly *Danthonia disticha* and *D. stricta* respectively

## VI FALSE GRASSVELD TYPES

### 61 BANKENVELD

(See Taljaard, Photo 71; King, Figs. 229, 230, 234)

It is possible that the climax of this veld type was an open savanna of *Acacia caffra*; certainly it still is in parts along its northern margin and sour bushveld regularly occurs on rocky outcrops and hills. It is a sparse and tall tufted type with the forbs playing an important part, and is extremely sour.

Three variations can be recognized: (a) The Western Variation, on sandy plains. (b) The Central Variation, of the Witwatersrand area, high-lying, largely stony country, with rolling topography. (c) The Eastern Variation, on sandy plains, but wetter than (a).

#### (a) The Western Variation of Bankenveld

This occurs on sandy plains and low rocky ridges, ranging in altitude from 1 350-1 700 m above the sea and receiving about 550-700 mm of rain per annum, falling in summer. It is a rather sparse, sour, strongly tufted veld and, in the nature of its grasses, clearly transitional from the *Cymbopogon-Therueda* Veld to the Sour Bushveld. The presence of important quantities of *Cymbopogon plurinodis*, and the general absence of *Tristachya hispida* distinguish it from the Central and Eastern Variations.

Species of general occurrence are:—

Eragrostis	Senecio venosus...	2 537
racemosa.....	138 800	
Digitaria	Acalypha angustata	2 448
tricholaenoides...	Diplachne biflora..	2 426
Setaria flabellata...	Triraphis	
Heteropogon	andropogonoides	2 338
contortus.....	Helichrysum	
Eragrostis	caespititum....	1 644
chloromelas.....	Trichoneura	
Elionurus argenteus	grandiglumis....	1 264
Themeda triandra..	Aristida diffusa var.	
Trachypogon	burkei.....	873
spicatus.....	Cymbopogon	
Brachiaria serrata	excavatus.....	818
var. serrata.....	Crabbea	
Diheteropogon	angustifolia.....	676
amplectens.....	Vernonia	
Cymbopogon	oligocephala.....	676
plurinodis.....	Polygonarthria	
Tristachya	squarrosa.....	613
rehmannii.....	Senecio coronatus..	609
Justicia	Elephantorrhiza	
anagalloides.....	elephantina.....	571
Bulbostylis	Andropogon	
burchellii.....	schirensis.....	522
Schizachyrium	Loudeania simplex..	102
sanguineum.....	Ziziphus zeyherana	91
Cassia mimosoides.	Hypoxis rooperi ..	45

Species of less general occurrence include:—

Pygmaeothamnus	Oxygonum	
zeyheri.....	dregeanum var.	
Tristachya hispida.	canescens.....	800
(eastwards).....	Dicoma anomala..	448
Digitaria eriantha..	Walafrida	
Anthospermum	densiflora.....	443
rigidum.....	Ophrestia	
Kohautia	oblongifolia.....	433
amatymbica.....	Sphenostylis	
Digitaria	angustifolia.....	324
monodactyla.....	Aristida	
Eustachys mutica..	aequiglumis.....	197
Cyperus	Cyanotis speciosa..	64
margaritaceus....	Stoebe vulgaris....	42
Bicum obovatum..	Arthrosolen	
Indigofera	sericeophalus....	30
oxytropis.....	Zornia milneana ..	22
	Clematopsis	
	scabiosifolia.....	1

and many more.

The number of species in the Relative Abundance Table is 203.

*Bauhinia esculenta*, with edible seeds, is of rare occurrence in this veld, but is common in parts of the marginal Kalahari Thornveld in Vryburg and Kuruman divisions.

#### (b) The Central Variation of the Bankenveld

This is the veld of the Witwatersrand and the high undulating country sloping down to the Magaliesberg, of the hills southwards towards the Vaal River, and of the northern edge of the eastern part of the Bankenveld (Fig. 96). The rocks are mainly quartzite, shale, dolomite and chert and granite, and the soils poor and acid, either stoney or sandy. Altitude ranges from 1 450-1 750 m above sea-level and rainfall from 700-750 mm per annum, falling in summer. The winters are severely frosty. Under these conditions, combined with regular burning, the veld is a particularly sour, wiry grassveld, virtually ungrazable in winter. On the other hand, the experiments at Rietvlei Research Station have shown what possibilities this veld offers for semi-intensive farming. Rocky hills and ridges carry a Bushveld vegetation dominated by *Protea caffra*, *Acacia caffra*, *Celtis africana* and sometimes (*Protea hirta* subsp. *glabrescens*) *P. welwitschii* subsp. *glabrescens*, with a large number of the South Bushveld shrubs in smaller quantity. A typical plant of the hills is *Xerophyta retinervis*. In sheltered valleys and sink-holes there are traces of temperate or transitional forest, with such species as *Celtis africana*, *Kiggelaria africana*, *Halleria lucida*, *Leucosidea sericea*, *Buddleia salviifolia* and *Cassinopsis ilicifolia*, e.g. in Fountains Valley at Pretoria, contrasting strongly with the traces of tropical forest a few miles away in the kloofs of the northern slopes of the Magaliesberg.

The typical species of the grassveld include:—

Trachypogon spicatus	D. tricholaenoides
Tristachya hispida	Setaria flabellata
Elionurus argenteus	S. nigrirostris
Heteropogon contortus	Eragrostis racemosa
Panicum natalense	E. chloromelas
Diheteropogon amplexens	E. capensis
Schizachyrium sanguineum	E. sclerantha
Loudetia simplex	E. gummiflava
Brachiaria serrata var.	Themedia triandra
serrata	Urelytrum squarrosum
Tristachya rehmannii	Aristida aequiglumis
Diplachne biflora	Rhynchelytrum setifolium
Monocymbium ceresiiforme	Cymbopogon excavatus
Digitaria monodactyla	

with a great wealth of forbs, e.g.:—

Sphenostylis angustifolia	Geigeria burkei
Senecio coronatus	Justicia anagalloides
S. inornatus and others	Cynium adonense
Helichrysum acutatum	Pearsonia cajanifolia
H. agrostophilum and	Vernonia natalensis and
others	others
Nidorella hottentotica and	Pentanisia prunelloides
others	Castalis spectabilis
Indigofera hilaris	Parinari capensis
I. fastigiata	Pygmaeothamnus zeyheri
I. velutina and others	

and many more.

Much of this country has been ploughed up in the past by natives (Moselekatze's people were settled here). On these ancient lands, *Hyparrhenia hirta* is abundant and a feature of the flatter parts of this veld type. In the sandier parts, overgrazing will bring in abundance of *Stoebe vulgaris*; on rocky ridges, of *Helichrysum kraussit*. It would appear that the southern element in this flora is strong, even though it is small in numbers.

FIG. 96.—Central Variation (61b) of Bankenveld at Rietvlei, Pretoria, in the Transvaal. *Pavetta zeyheri* at left and *Cussonia paniculata* at right.



### (c) The Eastern Variation of the Bankenveld

This is very flat sandy country. On the rocky outcrops, the veld resembles the Central Variation, as it does along the northern margin, being transitional to Sour Bushveld. Rainfall ranges from 600-750 mm per annum and altitude ranges from 1 350-1 700 m.

Species of general occurrence are:—

<i>Tristachya hispida</i> ..	132 154	<i>Diplachne biflora</i> ...	4 267
<i>Eragrostis racemosa</i> 107 640		<i>Tristachya rehmannii</i> .....	3 344
<i>Heteropogon contortus</i> .....	82 425	<i>Andropogon schirensis</i> .....	2 646
<i>Trachypogon spicatus</i> .....	59 418	<i>Helichrysum coriaceum</i> .....	2 046
<i>Digitaria tricholaenoides</i> ..	51 390	<i>Eragrostis plana</i> ...	1 884
<i>Themeda triandra</i> ..	48 859	<i>Aristida aequiglumis</i> .....	1 659
<i>Brachiaria serrata</i> var. <i>serrata</i> .....	48 382	<i>Urelytrum squarrosum</i> .....	1 381
<i>Microchloa caffra</i> ..	33 006	<i>Aristida congesta</i> subsp. <i>congesta</i> ..	1 288
<i>Elionurus argenteus</i> 29 811		<i>Cymbopogon excavatus</i> .....	873
<i>Diheteropogon amplectens</i> .....	23 064	<i>Eragrostis gummiflua</i> .....	537
<i>Schizachyrium sanguineum</i> .....	14 642	<i>Hyparrhenia hirta</i> ...	398
<i>Panicum natalense</i> ..	10 705	<i>Stoebe vulgaris</i> ....	88
<i>Monocymbium ceresiiforme</i> .....	10 381	<i>Dicoma anomala</i> ...	23
<i>Eragrostis chloromelas</i> .....	4 844		

Species of less general occurrence include:—

<i>Digitaria monodactyla</i> ....	40 875	<i>Setaria nigrirostris</i> .	1 095
<i>Loudetia simplex</i> ...	13 426	<i>Schizachyrium ursulus</i> .....	1 005
<i>Setaria flabellata</i> ...	10 149	<i>Acalypha angustata</i>	963
<i>Ficinia</i> spp.....	4 178	<i>Eragrostis sclerantha</i> .....	867
<i>Cynodon dactylon</i> ..	2 895	<i>Aristida junciformis</i>	622
<i>Sporobolus centrifugus</i> .....	2 432	<i>Harpochloa falx</i> ....	395
<i>Diheteropogon filifolius</i> .....	2 281	<i>Vernonia oligocephala</i> ....	342
<i>Eragrostis capensis</i> . 1 635		<i>Alloteropsis semialata</i> .....	171
<i>Ctenium concinnum</i> .....	1 571	<i>Eragrostis curvula</i> ..	89
<i>Parinari capensis</i> ... 1 478		<i>Senecio coronatus</i> ..	4

and many more, the number of species in the Relative Abundance Table being 201. *Tristachya biseriata* is sometimes abundant on rocky outcrops. Eastwards, this veld type merges gradually into the North-eastern Sandy Highveld.

In loosely sandy parts of this veld, the grass is particularly wiry and sparse, dominated by such species as *Digitaria brazzae*, *Tristachya rehmannii*, *Eragrostis curvula*, *E. racemosa* and *Perotis patens*, with some *Themeda* and *Heteropogon*. Outliers on sandstone in the North-eastern Sandy Highveld, likewise are extraordinarily sour and wiry, including the more useful grasses only as rarities. The north-eastern outliers, at Lydenburg and in sandy valleys in the mountains between Lydenburg and Roos Senekal, are a little different, being transitional to Piet Retief Sourveld in having *Eulalia villosa*, rather more *Themeda*, and both *Elionurus* and *Loudetia* of a form which is typical of the Piet Retief Sourveld. A conspicuous forb in this veld around Lydenburg is *Argyrolobium wilmsii*.

### 62 BANKENVELD TO SOUR SANDVELD TRANSITION

This is very sour veld on pale, sandy soil, closely related to the sandier parts of the Eastern Variation of the Bankenveld, but lacking such species as *Tristachya rehmannii* and *Schizachyrium sanguineum*. It requires more study.

### 63 PIET RETIEF SOURVELD

In this veld type, as in the Bankenveld, there are indications that it could originally have been thornveld or bushveld of an open, sour type, with scrub forest in sheltered places. That is the reason for including it among the false grassveld types, although it is, to-day, for practical purposes grassveld, with patches of bush and scrub-forest in sheltered places (Fig. 97). Its altitude ranges from 800-1 700 m, mostly 1 200-1 500 m, and its rainfall from 750-1 150 mm per annum, falling in summer.

The scrub-forest relics include:—

<i>Scolopia mundii</i>	<i>Grevillea sutherlandii</i>
<i>Leucosidea sericea</i>	<i>Alsophila dregei</i>
<i>Pittosporum viridiflorum</i>	<i>Cussonia spicata</i>
<i>Cephalanthus natalensis</i>	<i>Halleria lucida</i>
<i>Buddleia auriculata</i>	<i>Ficus capensis</i>
<i>Faurea speciosa</i>	<i>F. petersii</i>
<i>Myrsine africana</i>	<i>F. sonderi</i>
<i>Apodytes dimidiata</i>	<i>Syzygium cordatum</i> W

FIG. 97.—Piet Retief Sourveld (63) near Vossman's Beacon in the south-eastern Transvaal. *Podocarpus latifolius* on granite outcrop.



Olinia sp.
Rhus pyroides
R. transvaalensis
R. dura
Pterocelastrus tricuspidatus
P. echinatus
Diospyros scabrida var. cordata
D. sp. cf. Diospyros pallens
Tapiphylloides parvifolium
Osyris lanceolata
Dais cotinifolia

Dalbergia obovata
Maesa lanceolata
Acacia davyi
A. sieberiana var. woodii
Heteromorpha arborescens
Rhamnus prinoides
Sparmannia ricinocarpa
Trimeria trinervis
Lasiostiphon anthylloides
Protea roupelliae
Ekebergia pterophylla
Lopholaena platyphylla

and many more, a rich and varied flora, very different from the simple *Leucosidea* scrub which occurs as a post climax above the real upper limit of the forest, e.g. near Wakkerstroom, near Clarens and west of Majuba.

On the escarpment at the upper edge of this veld type are some surprisingly complete Fynbos relics, e.g. on Athole Research Station, east of Ermelo. Here, on sandstone ledges and small krantzes above the relics of scrub forest, mainly *Alsophila dregei*, occur small patches of Fynbos-like vegetation, with such species as the following:—

Protea roupelliae
Erica oatesii
E. cerinthoides
E. alopecurus
Osmunda regalis
Psoralea polysticta

and patches of *Festuca costata* on the slopes.

The grassveld is sour and rather sparse; large tufts of *Eulalia villosa*, with their dark, red-brown colour in winter, are typical of this veld.

Species of general occurrence are:—

Tristachya hispida
Themedia triandra
Rendlia altera
Eragrostis racemosa
Andropogon schirensis
Monocymbium ceresiiforme
Trachypogon spicatus
Microchloa caffra
Brachiaria serrata
Diheteropogon amplexens

Species of less general occurrence include:—

Diheteropogon filifolius
Aristida junciformis
Elionurus argenteus
Cymbopogon excavatus
Ctenium concinnum
Panicum ecklonii
Helichrysum oreophilum

Pentanisia prunelloides
Veronica natalensis
Harpochloa falx
Helichrysum simillimum
Schizachyrium sanguineum
Dicoma anomala

and many more, the number of species in the Relative Abundance Table being 134.

Forbs are particularly common and showy in this veld type, but as this survey was made mostly in winter, few of them figure in the Relative Abundance Table. The spectacular soil erosion in this region has already been mentioned (p. 28); the vertical sides of these big dongas will sometimes be found to be completely stabilized by a stoloniferous fern, *Dicranopteris linearis*, an interesting demonstration of the capabilities of the pre-angiosperm flora.

#### 64 THE NORTHERN TALL GRASSVELD

Even more than the Piet Retief Sourveld, this veld type is a patchwork of *Hyparrhenia*-dominated old lands; but otherwise it is a sourveld, completely dominated by *Tristachya hispida* (Fig. 98). The granite on which most of it occurs will no doubt explain this.

Species of general occurrence are:—

Tristachya hispida
Eragrostis racemosa
Microchloa caffra
Diheteropogon amplexens
Rendlia altera
Setaria nigrirostris
Brachiaria serrata
Digitaria spicata
Themeda triandra
Hypparrhenia hirta
Trachypogon spicatus
Setaria nigrirostris
Eulalia villosa
Eragrostis plana
Panicum natalense
Berkheya setifera

and many more, the number of species in the Relative Abundance Table being 220. As in the Piet Retief Sourveld, forbs are plentiful and showy in spring, e.g.:—

Senicio scleratus	Phyllanthus glaucophyllus
Acalypha angustata	Gnidia microcephala
Indigofera oxytropis	Erythrina zeyheri
I. hilaris	Sphenostylis marginata
I. hedyantha and others	subsp. marginata
Chascanum latifolium	Gerbera aurantiaca and
Eriosema salignum	others
E. burkei and others	Vigna unguiculata
Berkheya echinacea	Felicia mossamedensis
Diospyros galpinii	Bicum obovatum
Lasiosiphon nanus and	Triumfetta welwitschii var.
others	hirsta
Tephrosia mactopoda	Cyphostemma
Hypoxis argentea	spinosipilosum
Alysicarpus zeyheri	Cissus diversilobata
Aeschynomene micrantha	Zornia milneana
Ceropagia scabriflora	Euryops laxus
Asclepias aurea	E. transvaalensis subsp.
Pelargonium	setilobus
aconitophyllum	Haemanthus amaryloides

and a lot more.

Scrub forest relics are similar to those of the Piet Retief Sourveld, but merge downwards into the Lowveld in the valleys.

## 65 THE SOUTHERN TALL GRASSVELD

(See Taljaard, Photo 113)

This veld type and the Sour Sandveld are closely related to the Northern Tall Grassveld, but less tropical as regards their bush relics. The Southern Tall Grassveld, being dominated by *Themeda* and *Hyparrhenia*, is the least sour of the three (Figs. 99 and 100). Rainfall ranges from 650—900 mm per annum, falling in summer. The ferocity of the thunderstorms in this region is not to be matched in other parts of the Republic. Altitude ranges from 600—1 350 m, though below 1 050 m the veld is transitional to the Valley Bushveld and 'Ngongoni veld.

The main block of this veld is in Natal at altitudes ranging from 1 050—1 350 m feet. Here it is an open savanna of *Acacia sieberana* var. *woodii* in sourish mixed grassveld with plentiful patches of *Hyparrhenia hirta* and other species of *Hyparrhenia*. Soils resemble those of the Dohne Sourveld in having



FIG. 98.—Northern Tall Grassveld (64) below Dumbe Mountain, Paulpietersburg in Natal. Grassveld: *Themeda triandra*, *Eulalia villosa*, *Trachypogon spicatus*, *Brachypodium flexuum*, *Cymbopogon validus* and *Monocymbium ceresiiforme*. Forest relic: *Apodytes dimidiata*, *Rapanea melanophloeos*, *Curtisia dentata*, *Combretum kraussii* and *Maesa lanceolata*.

Species of less general occurrence include:—

Elionurus argenteus	4 349	Pentanisia	915
Helichrysum simillimum.....	2 879	prunelloides.....	585
Eragrostis chloromelas.....	1 187	Eulalia villosa.....	578
Anthospermum rigidum.....	1 057	Hypoxis rigidula...	378
		Senecio coronatus..	23
		Eragrostis capensis	



FIG. 99.—Southern Tall Grassveld (65) near Colenso in Natal. *Acacia sieberana* var. *woodii* with grass cover of *Themeda triandra*, *Tristachya hispida* and *Hyperthelia tampa*.

an erodible subsoil, but the top soil is much shallower (300-450 mm) so that erosion is severe in this veld type. *Themeda* and *Hyparrhenia* are most abundant on dolerite, and most of the outliers of the Southern Tall Grassveld are on dolerite. Hillsides and the deeper valleys have an *Acacia caffra*-savanna, which is marginal to the Valley Bushveld, and often, on south and east aspects, scrub-forest, which merges into the Valley Bushveld downwards and into the Highland Sourveld forest upwards. This *Acacia caffra*-savanna appears to be natural, but is slowly spreading up the valleys, accompanied by thickets of *Acacia nilotica* subsp. *kraussiana*. There are indications that the natural vegetation of the flat, exposed parts of this veld type may have been scrub forest, perhaps rather clumpy around *Acacia sieberana* var. *woodii* trees.

Species of general occurrence in the southern tall grassveld are:—

<i>Themeda triandra</i> ..	411 720	<i>Cymbopogon</i>	
<i>Hyparrhenia hirta</i> ..	141 995	excavatus.....	3 515
<i>Tristachya hispida</i> ..	103 178	<i>Cynodon dactylon</i>	3 514
<i>Heteropogon contortus</i> .....	73 390	<i>Helichrysum</i>	
<i>Eragrostis racemosa</i> ..	43 601	rugulosum.....	3 175
<i>Trachypogon spicatus</i> .....	33 825	<i>Diheteropogon</i>	
<i>Eragrostis chloromelas</i> ....	23 535	amplectens.....	2 459
<i>Elionurus argenteus</i> ..	22 496	<i>Acalypha</i>	
<i>Eragrostis plana</i> ...	21 457	peduncularis.....	1 674
<i>Microchloa caffra</i> ..	20 130	<i>Scabiosa</i>	
<i>Sporobolus africanus</i> .....	11 372	columbaria.....	1 040
<i>Eragrostis capensis</i> ..	8 642	<i>Setaria nigrirostris</i>	906
<i>Brachiaria serrata</i> var. <i>serrata</i> ....	6 844	<i>Pentanisia</i>	
		prunelloides.....	648
		<i>Aristida congesta</i>	
		subsp. <i>barbicollis</i>	448
		<i>Rhynchosia totta</i> ..	408
		Berkheya sp. (=A. 10117).....	14

Species of less general occurrence include:—

<i>Digitaria tricholaenoides</i> ...	26 712	<i>Sporobolus stapfianus</i> .....	1 067
<i>Hermannia depressa</i> .....	5 469	<i>Andropogon appendiculatus</i> ...	988
<i>Setaria flabellata</i> ...	4 651	<i>Zornia milneana</i> ...	840
<i>Thesium costatum</i> var. <i>juniperinum</i> .	1 261	<i>Fimbristylis monostachya</i> ....	782
<i>Hoffmannseggia sandersonii</i> .....	1 185	<i>Cymbopogon plurinodis</i> .....	582

and many more, the number of species in the Relative Abundance Table being 512.

Typical species in the scrub forest are the following (the arrows in this case indicate whether the particular species is more common towards the temperate forest or towards the valley bushveld):—

<i>Dombeya cymosa</i> ↓		<i>Rhus rehmanniana</i>	
<i>Rhoicissus tridentata</i>		<i>Buddleia dysophylla</i>	
<i>Hippobromus pauciflorus</i>		<i>Greyia sutherlandii</i> ↑	
<i>Rhus dentata</i> var. <i>grandifolia</i> ↑		<i>Commiphora harveyi</i>	
<i>Aloe arborescens</i>		<i>C. zanzibarica</i>	
<i>Ficus burtt-davyi</i>		<i>Ozoroa paniculosa</i>	
<i>Acacia caffra</i>		<i>Dais cotinifolia</i>	
<i>A. karroo</i>		<i>Buddleia saligna</i> ↓	
<i>A. nilotica</i> subsp. <i>kraussiana</i> ↓		<i>Jasminum angulare</i> ↓	
<i>Cussonia spicata</i>		<i>Cassinopsis ilicifolia</i>	
<i>Maytenus heterophylla</i>		<i>Canthium ciliatum</i> ↑	
<i>Tarchonanthus camphoratus</i> var. <i>camphoratus</i> ↓		<i>Halleria lucida</i> ↑	
<i>Euclea crispa</i> var. <i>crispia</i>		<i>Olénia</i> sp. ↑	
<i>Grewia occidentalis</i>		<i>Calpurnia woodii</i> ↑	
<i>Rhus pentheri</i> ↓		<i>C. intrusa</i> ↓	
<i>Allophylus decipiens</i>		<i>C. aurea</i> subsp. <i>aurea</i>	
<i>Ziziphus mucronata</i> ↓		<i>Trimeria trinervis</i>	
<i>Celtis africana</i>		<i>Maytenus peduncularis</i> ↑	
<i>Pavetta cooperi</i>		<i>Clausena anisata</i>	
		<i>Leonotis intermedia</i>	
		<i>Rhamnus prinoides</i>	
		<i>Rubia petiolaris</i> ↓	

and many more.

On the slopes of the Biggarsberg and northwards, is a transition to the Northern Tall Grassveld. Traces of the Southern Tall Grassveld are to be found in valleys south of the limit shown on the map, e.g. the valleys of the Upper Keiskamma, Tyumie and Mancazana Rivers.

## 66 NATAL SOUR SANDVELD

This veld type occurs in the basins of the Waschbank, Buffalo and Upper White Umfolosi Rivers on badly drained, shallow, sandy soil. It is generally a very open savanna of *Acacia sieberana* var. *woodii* in a poor sourveld; only in parts, particularly where streams debouch from the kloofs on to the plains, does *Acacia sieberana* var. *woodii* become plentiful (Fig. 100). The scrub forest of the hills is similar to that of the Southern Tall Grassveld, but rather more tropical.

Altitude ranges from 900-1 350 m and rainfall from 600—900 mm per annum, falling in summer.

Species of general occurrence are:—

<i>Tristachya hispida</i> ..	219 815	<i>Microchloa caffra</i> ..	9 345
<i>Digitaria tricholaenoides</i> ...	209 424	<i>Paspalum orbiculare</i> .....	6 844
<i>Eragrostis racemosa</i> ..	102 122	<i>Eragrostis planiculmis</i> .....	5 942
<i>Heteropogon contortus</i> .....	96 064	<i>E. gummiflua</i> .....	4 674
<i>Elionurus argenteus</i> ..	42 537	<i>Brachiaria serrata</i> var. <i>serrata</i> .....	4 610
<i>Hyparrhenia hirta</i> ..	28 323	<i>Helichrysum rugulosum</i> .....	3 877
<i>Cynodon dactylon</i>	24 867	<i>Andropogon eucomus</i> .....	3 508
<i>Trachypogon spicatus</i> .....	22 952	<i>Diheteropogon amplexens</i> .....	2 744
<i>Helichrysum simillimum</i> .....	18 520	<i>Loudetia simplex</i> ...	2 512
<i>Eragrostis chloromelas</i> ....	14 466	<i>Andropogon schirensis</i> .....	2 075
<i>Monocymbium ceresiiforme</i> ....	13 231	<i>Eragrostis plana</i> ....	1 746
<i>Aristida junciformis</i> ..	12 641	<i>Panicum natalense</i> .	870
<i>Diheteropogon filifolius</i> .....	10 990		

Species of less general occurrence include:—

<i>Themeda triandra</i> ..	17 933	<i>Alloteropsis semialata</i> .....	1 081
<i>Andropogon appendiculatus</i> ...	17 561	<i>Setaria nigrirostris</i> ..	1 044
<i>Sporobolus africanus</i> .....	7 270	<i>Helichrysum caespititum</i> .....	671
<i>Fimbristylis complanata</i> .....	4 111	<i>Eragrostis capensis</i>	564
<i>Digitaria monodactyla</i> ....	3 293	<i>Harpochloa falx</i> ...	470
<i>Aristida congesta</i> subsp. <i>barbicollis</i>	3 191	<i>Cymbopogon excavatus</i> .....	390
<i>Eragrostis sclerantha</i> .....	2 333	<i>Dicoma anomala</i> ...	221
<i>Anthospermum rigidum</i> .....	1 270	<i>Urelytrum squarrosum</i> ....	176
<i>Pogonarthria squarrosa</i> .....	1 180	<i>Pentanisia prunelloides</i> ....	52
		<i>Cassia mimosoides</i> .	17

and many more, the number of species in the Relative Abundance Table being 157.

Extensive areas are waterlogged in summer; here *Andropogon eucomus*, *Imperata* and a variety of sedges and rushes are important constituents of the veld.

The best seasons for mapping these grassy veld types are autumn and winter, when they are more or less dry, because then the distinctive colours of the dominant grasses show up better—thus *Themeda* is purple-pink, *Elionurus* yellow, *Hyparrhenia* cream, *Eulalia* dark red-brown, *Tristachya*, *Loudetia* and *Digitaria tricholaenoides* grey, *Diheteropogon amplexens* mauve, *Andropogon schirensis* purple-brown, *Eragrostis plana*, *E. chloromelas* and *E. curvula* white, and so on. In spring, when the veld is green, these differences in colour are very much less evident.



FIG. 100.—A view from the Normandien Pass in Natal of Highland Sourveld (44a) in foreground, Southern Tall Grassveld (65) in middle distance and Natal Sour Sandveld (66) on flat areas in far distance.

## 67 PIETERSBURG PLATEAU FALSE GRASSVELD

The climax of this plateau is clearly open, clumpy Sourish Mixed Bushveld, with *Acacia rehmanniana* as the typical tree. Altitude ranges from 1 200—1 500 m and rainfall from 400—600 mm per annum, falling in summer. The rock is granite.

The principal species are:—

<i>Themeda triandra</i>	<i>Eragrostis racemosa</i>
<i>Hypparrhenia hirta</i>	<i>Brachiaria serrata</i> var. serrata
<i>Heteropogon contortus</i>	
<i>Aristida canescens</i>	<i>B. nigropedata</i>
<i>A. diffusa</i> var. <i>burkei</i>	<i>Eragrostis superba</i>
<i>Trachypogon spicatus</i>	<i>Sporobolus nitens</i>
<i>Schizachyrium sanguineum</i>	<i>Triraphis andropogonoides</i>
<i>Elionurus argenteus</i>	<i>Digitaria argyrograpta</i>
<i>Andropogon schirensis</i>	<i>Cymbopogon plurinodis</i>
<i>Eragrostis chloromelas</i>	<i>C. excavatus</i>

*Acacia rehmanniana*, *A. tortilis* subsp. *heteracantha*, *A. hebeclada* subsp. *hebeclada* and *Maytenus senegalensis* occur scattered through it, with *Acacia permixta* along its northern margin where it merges into the Open *Sclerocarya* Veld. *Aristida congesta* subsp. *barbicollis* is abundant in tramped out parts.

## 68 EASTERN PROVINCE GRASSVELD

Surviving good samples of this veld show it to be one of the densest grassveld types in the Republic. It lies on undulating country, at altitudes ranging from 550—900 m, along the foot of the mountains from Bruintjieshoogte to Debe Nek. Rainfall ranges from 350—650 mm per annum, falling mostly in summer. Extensive patches still remain as grassveld, but most of it is becoming invaded by thornveld and Karoo. It is included amongst the false grassveld types because it is suspected that the climax is temperate scrub forest.

Species of general occurrence are:—

<i>Themeda triandra</i> .. 540 000	<i>Cynodon incompletus</i> .... 4 325
<i>Eragrostis chloromelas</i> .... 372 679	<i>Eustachys mutica</i> ... 3 366
<i>Digitaria argyrograpta</i> .... 218 000	<i>Felicia muricata</i> .... 2 280
<i>Microchloa caffra</i> .. 216 120	<i>Pelargonium sidaeifolium</i> .... 1 926
<i>Heteropogon contortus</i> .... 116 130	<i>Helichrysum dregeanum</i> .... 1 622
<i>Eragrostis obtusa</i> ... 57 670	<i>Hermannia incana</i> .... 442

<i>Tragus koelerioides</i> ..... 11 301	<i>Selago triquetra</i> .... 300
<i>Cymbopogon plurinodis</i> ..... 5 360	<i>Eragrostis curvula</i> .. 177
<i>Sporobolus fimbriatus</i> ..... 5 340	<i>Hibiscus atrococcineus</i> .... 168
	<i>Sutera pinnatifida forma</i> ..... 35
	<i>Acacia karroo</i> ..... 17

Species of less general occurrence include:—

<i>Panicum stipianum</i> ..... 3 900	<i>Mariscus dregeanus</i> .... 832
<i>Helichrysum rugulosum</i> ..... 1 800	<i>Argyrolobium pauciflorum</i> .... 808
<i>Anthericum dalyae</i> 1 600	<i>Crassula turrita</i> .... 803
<i>Eragrostis capensis</i> 1 600	<i>Mariscus capensis</i> .... 803
<i>Blepharis integrifolia</i> ..... 880	<i>Cyanotis speciosa</i> .... 541
	<i>Cyperus usitatus</i> .... 461

and many more, the number of species in the Relative Abundance Table being 152.

Under conditions of selective overgrazing this veld breaks down to *Digitaria argyrograpta*, *Eragrostis obtusa*, *E. chloronelas*, *Sporobolus fimbriatus* and *Tragus koelerioides*, which may be quite dense, but not so dense at ground level as to keep out Karoo bushes, e.g. *Nenax microphylla*, *Sutera pinnatifida forma*, *Nestlera humilis*, *Euryops anthemoides*, *Selago triquetra*, *Pelargonium abrotanifolium*, *Walafrida saxatilis* and *Pentzia incana*.

Under conditions of continuous grazing so heavy as to be relatively non-selective, *Microchloa* tends to replace *Themeda*, etc., growing very densely, with stunted *Felicia muricata* and smaller quantities of very short *Hermannia incana*, *Helichrysum dregeanum*, *Sporobolus discosporus* and *Aristida congesta* subsp. *barbicollis*. If such veld were rested, the growing out of these stunted Karoo species might give the superficial observer the impression that the effect of resting is to bring in the Karoo.

It should be noted that there is more of this veld below Bedford and Kroomie than is shown on the map.

## VII SCLEROPHYLLOUS BUSH TYPES

### 69 MACCHIA

(See Marloth I, Pl. 22, 27, 36, Fig. 80; II, 1, Pl. 14; II, 2, Pl. 72; III, 1, Pl. 1, 6, 28, Fig. 60B, Pl. 38; III, 2, Pl. 58, Figs. 105, 109; IV, Pl. 4A; Taljaard, Photo 18; Reynolds, Pl. 77; Hutchinson, facing p. 64; Adamson, Photos 1,2)

FIG. 101.—Pietersburg Plateau False Grassveld (67) just north of Pietersburg in the Transvaal. Species noted: *Themeda triandra*, *Digitaria eriantha*, *Bracharia nigropedata*, *Eragrostis superba*, *E. rigidior* and *Acacia rehmanniana*.



This vegetation type, usually known as Fynbos (Figs. 102 and 103), is the southern vegetation, different in origin and nature from the tropical vegetation, but to-day very much mixed up with it. It is a complex vegetation, and to divide it simply into Macchia and False Macchia is like dividing the tropical vegetation into grassveld and bushveld, i.e. in this preliminary map and description we are not really subdividing this southern vegetation in the same way as we have subdivided the tropical vegetation.

In the case of the tropical vegetation, forest, bushveld and grassveld are each dominated by a few species, which occur all through each of these vegetation types, combining in varying proportions to form the veld types. In the case of the southern vegetation, there is no such dominance of a few species. This might be interpreted as indicating that the southern vegetation is the older. The best we can do is to draw up a list of families and genera occurring as dominants in all the variations of the fynbos, thus:—

PROTEACEAE	
Protea	ROSACEAE
Leucadendron	Cliffortia
Leucospermum	BRUNIACEAE
Serruria	Brunia
Paranomus and others	Berelia
ERICACEAE	Tittmannia and others
Erica	GERANIACEAE
Simocheilus	Pelargonium
Philippia	Monsonia and others
Blaeria and others	HAEMODORACEAE
LEGUMINOSAE	Wachendorfia
Aspalathus	Cyanella
Podalyria	Diliatris and others
Cyclopia	LILIAEAE
Amphithalea and others	Ornithogalum
RESTIONACEAE	Bulbinella
All genera	Dipidax
CYPERACEAE	Lachenalia and others
Tetaria	ORCHIDACEAE
Ficinia	Disa
Chrysithrix and others	Acrolophia
GRAMINEAE	Satyrium and others
Merxmuellera	COMPOSITAE
Pentaschistis	Metalasia
Ehrharta	Ursinia
Plagiochloa	Othonna
Lasiochloa and others	Euryops
RHAMNACEAE	Helipterum
Phyllica	Helichrysum
PENAEACEAE	Stoebe
All genera	Elytropappus
	Cullumia

RUTACEAE	Pteronia
Diosma	Pentzia
Agathosma	Senecio
Acmaenia	Corymbium
Macrostylis and others	Eriocephalus and others
THYMELEAEACEAE	GRUBBIACEAE
Gnidia	Grubbia
Passerina	AMARYLLIDACEAE
Cryptadenia and others	Amaryllis
AIZOACEAE	Nerine
Acrosanthes	Gethyllis
Pharnaceum	Hypoxis
Polpoda and others	Brunsvigia and others
BORAGINACEAE	IRIDACEAE
Lobostemon	Moraea
Echiostachys	Homeria
VERBENACEAE	Gladiolus
Stibe	Lapeirousia
Campylostachys	Sparaxis
CAMPANULACEAE	Ixia
Lightfootia	Tritonia
Prismatocarpus	Watsonia
Lobelia	Mirranthus
Merciera and others	Romulea
POLYGALACEAE	Anapalina
Polygala	Petamenes
Muraltia	Geissorhiza and others
Nylandtia	

Any typical sample of Fynbos will have most, if not all, of these genera and a lot more, but the majority of the species will vary from mountain to mountain.

The Fynbos is particularly associated with sandstone and poor, white, sandy soil in regions receiving a winter rainfall. It requires at least 250 mm of rain per annum. Two broad divisions are usually recognized; Fynbos and Arid Fynbos. The latter is particularly interesting as tending to develop, under conditions of grazing mismanagement, a generic composition much like that of the Karroid False Fynbos that invades the grassveld of the mountains of the Upper Plateau, in which such typical families as Proteaceae, Rutaceae and Ericaceae are poorly represented or not at all.

In the wetter, warmer parts, the Fynbos succession leads on, via tall *Protea*, *Leucadendron*, *Podalyria*, *Aspalathus*, *Chrysanthemoides*, *Virgilia* and others to *Podocarpus* and *Widdringtonia* forest, but a great number of tropical species also have a place in this succession and climax, except on the Cedarberg. There seems to be little place for grassveld in this succession, though there are a few indications that more than one kind of grassveld is possible,



FIG. 102.—Macchia (69) on slopes of the Klein River Mountains near Hermanus in the south-western Cape.



FIG. 103.—Macchia (69) on Table Mountain, south-western Cape. *Helichrysum vestitum* and *Elytropappus rhinocerotis* in the foreground.

quite apart from the invading tropical grassveld. It is probable that the Restionaceae have replaced a lot of grass, especially at higher altitudes. The replacement of the shaly parts of it by Rhenosterbosveld has already been mentioned (p. 81).

This brief outline of the Macchia will have to suffice at this stage.

#### VIIA FALSE SCLEROPHYLLOUS BUSH TYPES

##### 70 FALSE MACCHIA

[See Hutchinson, facing p. 321 (Grahamstown)]

Most of this veld type (Fig. 104) is to-day indistinguishable from the true Macchia, but there are plenty of indications that in its natural condition it would have been transitional from the Dohne Sourveld to the Macchia, and much resembling the

veld of the summits of the Amatolas and Katberg. Wetter southern aspects would have had a transitional forest climax. The dominance of *Aristida junciformis* and other tropical grassveld species in the neighbourhood of Swellendam has already been mentioned (p. 21), as has the grassiness of the eastern part of this veld type (p. 8), where the process of conversion of a sour grassveld into Fynbos can be seen going on.

Beyond pointing out the dominance of Compositae (*Othonna*, *Euryops*, *Ursinia*, etc.) in parts of this veld on northern aspects after burning, which may be taken to foreshadow the dominance of Composites in the derived non-succulent Karoo, we will leave a discussion of it for another occasion.



FIG. 104.—False Macchia (70) in the Stuurberg Pass area of the Cape. Genera present: *Elytropappus*, *Phyllica*, *Erica*, *Clifftoria*, *Passerina*, *Leucospermum*, *Metalasia*, *Coleonema*, *Euryops*, *Ficinia*, *Bobartia*, *Themeda*, *Pentaschistis* and *Restio*.



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## Addendum: changes to map

Although it was considered unnecessary to revise the veld types map for this edition, the following changes will have to be made in the next edition:—

1. Narrow belts of Mountain Rhenosterveld (43) occur in Namaqualand to the west of Steinkopf, Springbok and Kamieskroon. This will later be described as a distinct variation.

2. Namaqualand Broken Veld (33) is considered to extend further south to include Biesiesfontein and Nuwerus.

3. Strandveld (34) north of the Olifants River is wider in parts.

4. The part of Namaqualand Broken Veld (33) in the Orange River valley between Vioolsdrift and Kakamas is now regarded as typical Orange River Broken Veld (32), while the Orange River Broken Veld of Griqualand West is now regarded rather as transitional to Vryburg Shrub Bushveld 17 (2) invaded by karoo.

5. The Southern Form (c) of Arid Karoo (29) is now regarded as Variation 1 of False Arid Karoo (35) derived from a south-western variation of Central Upper Karoo (27).

6. The western part of the Kareebergen of Carnarvon is now thought to have been a central variation of Central Upper Karoo (27), which has become Variation 2 of False Arid Karoo (35).

7. The area of Karroid *Merxmuellera* Mountain Veld (60) that has been converted into False Karoo (42) is greater than shown on the map, including some of both False Central Upper Karoo (36) and Karroid *Merxmuellera* Mountain Veld especially on the northern side of the mountains.

8. Karroid *Merxmuellera* Mountain Veld (60) shown east of Sterkstroom and east of the Upper Swart Kei River is incorrect. It should be Dohne Sour Veld (40) at higher levels eg. south of Romanslaagte, and *Cymbopogon-Themedea* Veld (48) at lower levels. The patches of Karroid *Merxmuellera* Mountain Veld that do occur are too small to justify calling the whole area Karroid *Merxmuellera* Mountain Veld.

9. The False Karoo boundary has moved further east and north.



# Index to species and genera

In this Index the following information is given, in this order:—

1. The value of the species. This is indicated by symbols:—

B. Undesirable plants which should be reduced in number by appropriate veld management.  
 BB.—Undesirable plants which should, or may have to, be eradicated by mechanical means.  
 P.—Poisonous plants of economic importance.  
 G.—Valuable plants to be encouraged by appropriate veld management.  
 GG.—Valuable plants which should, or may have to, be encouraged by reseeding.

All the rest, to which no symbol is attached, are the ordinary plants which make up the bulk of the vegetation, neither outstandingly good nor outstandingly bad. Had the vegetation consisted only of first-class grazing plants, South Africa would long since have become a total desert.

2. The numbers of the specimens on which the writer's knowledge of the species is based. In practically all cases the determinations were made by the National Herbarium, except for the mesembs, which were determined by the late Dr Bolus at the Bolus Herbarium from fresh material sent by post. The necessary cartons and boxes were provided by various storekeepers, to whom thanks are due.

3. The pages on which the species or genus is mentioned.

<i>Abrus laevigatus</i> E. Mey. ....	53	<i>Acanthosicyos naudiniana</i> (Sond.) 34, 39, 40
<i>Abutilon sonneratianum</i> Sweet ....	53	<i>Achyranthes aspera</i> L. .... 14, 17, 19, 82, 85
<i>Acacia</i> ....	8, 29, 30, 33, 36, 37, 47, 49, 86	<i>Achyropis leptostachya</i> (E. Mey. & Meisn.) Hook.f. .... 53
<i>A. albida</i> Del. ....	15, 23, 28, 29	<i>Acacia</i> .... 105
<i>A. ataxacantha</i> DC. ....	19, 23, 26, 27, 53	<i>Acokanthera oppositifolia</i> (Lam.) 18, 53
<i>A. burkei</i> Benth. ....	28, 49	<i>Acrolaphia</i> .... 105
<i>A. caffra</i> Willd. ....	7, 23, 24, 27, 32, 33, 44, 48, 49, 50, 52, 53, 54, 99, 103	<i>Acrosanthes</i> .... 105
<i>A. davyi</i> N.E. Br. ....	24, 27, 28, 49, 101	<i>Acrotome inflata</i> Benth. .... 43
<i>A. erioloba</i> E. Mey. (= <i>A. giraffae</i> Willd.) ....	3, 32, 34, 39, 40, 43, 72, 74	<i>Adansonia</i> .... 33, 35, 36
<i>A. erubescens</i> Welw. ex Oliv. ....	30, 34, 37, 38, 45, 47	<i>A. digitata</i> L. .... 30, 36, 37, 38
<i>A. exuvialis</i> Verdoorn ....	30	<i>Adenia glauca</i> Schinz, P. .... 29
<i>A. gerrardii</i> Benth. var. <i>gerrardii</i> ....	23, 28, 31, 32, 49	<i>A. gumifera</i> (Harms) .... 19
(= <i>A. giraffae</i> Willd.) <i>A. erioloba</i> E. Mey. ....	40	<i>A. oleifolium</i> Stapf .... 72
<i>A. haematoxylon</i> Willd. ....	38, 40	<i>Adenium</i> .... 4
<i>A. hebeclada</i> DC. subsp. <i>hebeclada</i> .	40, 43, 104	<i>Adhatoda andromeda</i> C.B.CI. .... 23
<i>A. karroo</i> Hayne, G, BB ....	8, 9, 13, 15, 16, 18, 19, 23, 24, 25, 31, 32, 33, 34, 36, 38, 41, 42, 43, 47, 49, 51, 52, 53, 54, 55, 57, 60, 62, 63, 69, 71, 72, 74, 80, 82, 86, 90, 92, 103, 104	<i>Adromischus</i> .... 71, 74
<i>A. huaderitzii</i> Engl. var. <i>huaderitzii</i> , BB ....	8, 16, 30, 31, 34, 37, 39	<i>A. inaculatus</i> (Salm Dyck) Lem. ex Berger .... 98
<i>A. mellifera</i> (Vahl.) Benth. subsp. <i>detinens</i> (Burch.) Brenan, BB	8, 32, 34, 37, 38, 39, 40, 41, 42, 43, 47, 72, 73, 79	<i>A. iwanmilaris</i> (L.f.) Lem. ex Berger 70
<i>A. nebrownii</i> Burtt Davy ....	48	<i>A. nanus</i> (N.E.Br.) von Poellnitz .. 98
<i>A. nigrescens</i> Oliv. ....	28, 30, 33, 35, 38, 46, 17	<i>A. poelnitzianna</i> Wederm. .... 55, 59
<i>A. nilotica</i> (L.) Willd. ex Del. subsp., <i>kraussiana</i> (Benth.) Brenan, BB	8, 23, 24, 28, 31, 32, 37, 45, 48, 52, 103	<i>A. sphenophylloides</i> C.A. Sm. .... 61, 70
<i>A. permixta</i> Burtt Davy ....	47, 48, 49, 104	<i>Aeolanthus parvifolius</i> Benth. .... 19
<i>A. rehmanniana</i> Schinz ....	48, 104, 105	<i>Aeschynomene uicirantha</i> DC. .... 102
<i>A. robusta</i> Burch. subsp. <i>robusta</i> .	23, 29, 32, 48, 49, 52, 53	<i>Agathosma ovata</i> (Thunb.) Pillans .. 20, 25, 59, 84
<i>A. schweinfurthii</i> Brenan & Exell var. <i>schweinfurthii</i>	53	<i>A. cerefolium</i> Bartl. & Wendl. .... 25
<i>A. senegal</i> (L.) Willd. var. <i>leiorhachis</i> Brenan	28, 30, 47	<i>A. spp.</i> .... 4, 105
<i>A. stuhlmannii</i> Taub. ....	32	<i>Agropyron distichuum</i> Beauv. .... 75
<i>A. sieberana</i> DC. var. <i>woodii</i> Burtt Davy	23, 24, 27, 101, 102, 103	<i>Agrostis lachnantha</i> Nees .... 64
<i>A. tenuispina</i> Verdoorn, BB ....	8, 31	<i>Aizoon burchellii</i> N.E. Br. .... 72, 73
<i>A. tortilis</i> (Forsk.) Hayne subsp. <i>heteracantha</i> (Burch.) Brenan, G, BB	23, 28, 30, 31, 32, 34, 35, 37, 38, 39, 40, 41, 42, 43, 46, 47, 48, 49, 79, 104	<i>A. cauaricense</i> L. .... 67, 77
<i>A. xanthophloea</i> Benth. ....	29, 30	<i>A. glinoides</i> L.f. .... 53
<i>Acalypha angustata</i> Sond. ....	99, 100, 102	<i>A. schellebergii</i> Adamson .... 66, 73
<i>A. glabrata</i> Thunb. ....	14, 32	<i>Ajuga ophrydis</i> Burch. ex Benth. .... 94
<i>A. glabrata</i> Thunb. var. <i>pilosior</i> (Kuntze) Prain	50, 53	<i>Alberta magna</i> E. Mey. .... 85
<i>A. peduncularis</i> E. Mey. ex Meisn. .	20, 23, 24, 103	<i>Albizia adianthifolia</i> (Schumach.). 13, 15, 16, 22, 23
<i>A. schinzii</i> Pax, B. ....	20, 23, 83	W. F. Wight
<i>Acanthaceae</i> ....	14, 17, 18, 19, 22, 26, 53, 54, 55, 57, 82, 84	<i>A. anthelmintica</i> (A. Rich.) Brongn. 44, 47
<i>Acanthopsis hoffmannseggiana</i> (Nees) C.B.CI.	66, 73	<i>A. tanganyicensis</i> Bak. f. .... 50
		<i>A. versicolor</i> Welw. ex Oliv. .... 23, 28
		<i>Allophylus decipiens</i> Radlk. .... 16, 18, 22, 51, 53, 84, 103
		<i>A. dregeanus</i> (Sond.) De Wint. .... 14, 17, 19, 26, 85
		<i>A. melanocarpus</i> (Sond.) Radlk. .... 14, 85
		<i>A. natalensis</i> (Sond.) De Wint. .... 16, 17, 18
		<i>Alloteropsis semialata</i> (R.Br.) Hitch. 14, 20, 23, 24, 27, 49, 83, 85, 86, 95, 100, 101, 103
		<i>Aloe</i> .... 29, 30, 47, 54, 57, 59
		<i>A. africana</i> Mill. .... 56
		<i>A. arborescens</i> Mill. .... 26, 57, 82, 86, 103
		<i>A. areuicola</i> Reynolds .... 70
		<i>A. bainesii</i> T.-Dyer .... 23, 54
		<i>A. broonii</i> Schonl. .... 98
		<i>A. ciliaris</i> Haw. .... 54
		<i>A. claviflora</i> Burch. .... 73
		<i>A. comptonii</i> Reynolds .... 59
		<i>A. daviana</i> Schonl. .... 39
		<i>A. dichotoma</i> Masson .... 4, 71, 72, 73, 74, 75
		<i>A. ferox</i> Mill. .... 4, 55, 56, 57, 58, 59, 63, 80, 86, 97

<i>A. grandidentata</i> Salm Dyck	41	<i>A. wilmsii</i> Harms	100
<i>A. hereroensis</i> Engl.	42, 72	<i>Aridaria calycina</i> L. Bol.	65, 70
<i>A. khamiesensis</i> Pillans	74	<i>A. noctiflora</i> (L.) Schwant.	61, 68, 71
<i>A. krapohliana</i> Marl.	70	<i>A. sp.</i> A. 14381	73
<i>A. lineata</i> (Ait.) Haw.	56	<i>A. sp. cf. A. noctiflora</i> (L.) Schwant.	64
<i>A. longistyla</i> Bak.	71	<i>Aristea cognata</i> N.E. Br.	24
<i>A. marlothii</i> Berg.	53	<i>Aristida</i>	3, 5, 34, 40, 42, 47, 75, 78
<i>A. mitriformis</i> Mill.	75	<i>A. adscensionis</i> L., B	45, 60, 64, 67, 68, 69, 71, 73, 78, 79, 92
<i>A. pillansii</i> L. Guthrie	74	<i>A. aequiglumis</i> Hack.	95, 99, 100
<i>A. pluridens</i> Haw.	56	<i>A. bipartita</i> (Nees) Trin. & Rupr.	29, 31, 32, 90, 92
<i>A. saponaria</i> (Ait.) Haw.	86	<i>A. canescens</i> Henr.	31, 49, 90, 104
<i>A. speciosa</i> Bak.	18, 56, 57, 59	<i>A. congesta</i> Roem. & Schult. subsp. <i>barbicollis</i> (Trin. & Rupr.) De Wint., B	24, 29, 30, 31, 32, 34, 35, 38, 40, 41, 43, 44, 47, 48, 49, 53, 64, 73, 78, 89, 90, 91, 103, 104
<i>A. spectabilis</i> Reynolds	23, 27, 53	<i>A. congesta</i> Roem. & Schult. subsp. <i>congesta</i> , B	32, 34, 35, 39, 40, 41, 46, 49, 51, 60, 62, 63, 64, 67, 68, 88, 90, 91, 92, 95, 100
<i>A. striata</i> Haw.	55	<i>A. diffusa</i> Trin. var. <i>burkei</i> (Stapf) Schweick., B, G	29, 39, 40, 41, 42, 43, 45, 50, 58, 59, 60, 63, 64, 71, 72, 73, 81, 86, 88, 90, 92, 95, 97, 98, 99, 104
<i>A. tenuior</i> Haw.	55	<i>A. engleri</i> Mez	42, 73, 74
<i>A. transvaalensis</i> Kuntze	37	<i>A. graciliflora</i> Pilg.	34, 39, 40, 44, 46, 47, 48, 49, 90, 91
<i>A. variegata</i> L.	71	<i>A. junciformis</i> Trin. & Rupr., B	15, 16, 17, 20, 21, 23, 83, 85, 86, 87, 88, 94, 95, 100, 101, 103, 106
<i>Aloinopsis</i>	81	<i>A. meridionalis</i> Henr.	39, 40
<i>A. malherbei</i> (L. Bol.) L. Bol.	64	<i>A. mollissima</i> Pilg.	39
<i>Alphosphaera capensis</i> (L.f.) J. Sm.	22	<i>A. sciurus</i> Stapf	29
<i>A. dregei</i> (Kunze) Tryon	22, 26, 27, 100, 101	<i>A. sp. cf. A. graciliflora</i> Pilg.	45
<i>Alysicarpus rugosus</i> (Willd.) DC.	23	<i>A. spectabilis</i> Hack.	50
<i>A. zeyheri</i> Harv.	102	<i>A. transvaalensis</i> Henr.	50
<i>Amaranthus schinzianus</i> Thell.	60	<i>Arrowsmithia stypheleoides</i> DC.	84
<i>Amaryllis</i>	105	<i>Artemisia afra</i> Jacq.	15, 28, 97
<i>Amellus strigosus</i> (Thunb.) Less.	67, 71	<i>Arthrocneumum natalense</i> (Bunge ex Ung.-Sternb.) Moss	86
<i>Amphithalea</i>	105	<i>A. pillansii</i> Moss	70
<i>Anacamptos telephiasstrum</i> DC.	98	<i>Arthrosolen sericeocephalus</i> Meisn.	99
<i>A. ustulata</i> E. Mey.	98	<i>A. sp.</i> A. 14458	71
<i>Anapalma</i>	105	<i>Arundinaria tessellata</i> (Nees) Munro	97
<i>Andrachne ovalis</i> (Sond.) Muell. Arg.	82, 84	<i>Asaemia axillaris</i> (Thunb.) Harv. ex Jackson, P, BB	64, 69, 77
<i>Androcymbium bellum</i> Schltr. & Krause	67	<i>Asclepias aurea</i> Schltr.	102
<i>A. roseum</i> Engl.	67	<i>A. buchananiana</i> Schinz, G	60, 75
<i>Andropogon</i>	49, 94	<i>A. burcellii</i> Schltr.	72
<i>A. appendiculatus</i> Nees	23, 83, 85, 88, 94, 95, 103	<i>A. multicaulis</i> Schltr.	94
<i>A. eucormus</i> Nees	103	<i>Aspalathus</i>	59, 87, 105
<i>A. schinzii</i> Hack.	27, 30, 42	<i>A. frankeniodes</i> DC.	84
<i>A. schirensis</i> Hochst.	23, 27, 42, 47, 48, 83, 86, 94, 95, 99, 100, 101, 103, 104	<i>A. laricifolia</i> Berg.	20, 25, 86
<i>Aneilema aequinoctiale</i> Kunth	19	<i>A. nivea</i> Thunb.	25
<i>A. dregeanum</i> Kunth	13	<i>A. setacea</i> Eckl. & Zeyh.	20
<i>Anna</i>	27	<i>A. suffruticosa</i> DC.	76
<i>Anomalesia saccata</i> (Klatt) Goldbl.	73	<i>Asparagus</i>	14, 19, 60, 63, 64, 69, 71
<i>Anomatheca laxa</i> (Thunb.) Goldbl.	14	<i>A. africanus</i> Lam.	18, 53, 56, 86
<i>Antephora pubescens</i> Nees	3, 34, 35, 36, 38, 39, 40, 42, 44, 48, 90	<i>A. asparagooides</i> (L.) Wight	18, 54, 57, 75, 86
<i>Anthericum</i>	89	<i>A. capensis</i> Thunb.	64, 70, 71, 81
<i>A. dalayae</i> Moss ined.	104	<i>A. compactus</i> Salter	68
<i>A. sp. A. 11313</i>	14	<i>A. falcatus</i> L.	17, 30, 53, 57, 75, 86
<i>Antierothonnus pearsonii</i> N.E. Br.	73	<i>A. fasciculatus</i> Thunb.	75
<i>Anthocleista grandiflora</i> Gilg	27	<i>A. laricinus</i> Burch.	31, 32, 40
<i>Anthospermum</i>	85, 98	<i>A. oxyacanthus</i> Bak.	19
<i>A. aethiopicum</i> L.	84	<i>A. racemosus</i> Willd.	18, 53, 54, 55, 56, 57, 61, 87
<i>A. herbaceum</i> L.f.	22	<i>A. retrofractus</i> L.	42, 75
<i>A. paniculatum</i> Cruse.	25	<i>A. sauveolens</i> Burch.	61, 86
<i>A. rigidum</i> Eckl. & Zeyh.	23, 39, 88, 89, 90, 92, 94, 95, 99, 102, 103	<i>A. setaceus</i> (Kunth) Jessop	14, 18, 22, 26, 53, 57, 82, 84
<i>A. sp. A. 10677</i>	20	<i>A. sp.</i> (stiff glaucous)	69, 79
<i>A. sp. A. 15844</i>	98	<i>A. stipulaceus</i> Lam., B	31, 37, 43, 54, 55, 57, 63, 70, 72, 73
<i>A. tricostatum</i> Sond.	59	<i>A. striatus</i> Thunb.	51, 54, 55, 57, 80
<i>Antidesma venosum</i> E. Mey. ex Tul.	27	<i>A. subulatus</i> Thunb.	53, 55, 56
<i>Antizoma angustifolia</i> (Burch.) Miers ex Harv.	40	<i>A. virgatus</i> Bak.	14, 22, 26, 53, 82, 84, 85
<i>A. capensis</i> (L.f.) Diels	72	<i>Asplenium adiantum-nigrum</i> L.	22
<i>A. miersiana</i> Harv.	74	<i>A. aethiopicum</i> (Burm. f.) Bech.	14, 22, 26, 82, 84, 85
<i>A. sp.</i> Pearson 8274, <i>A. 14260</i>	75	<i>Aster bakerianus</i> Burtt Davy	23
<i>Apatesia sabulosa</i> (Thunb.) L. Bolus	70	<i>A. sp. A. 12598</i>	51, 64
<i>Apodytes dimidiata</i> E. Mey. ex Arn.	13, 15, 16, 18, 19, 21, 22, 24, 26, 50, 53, 82, 84, 100, 102	<i>Asthenatherum glaucum</i> (Nees) Nevski	40, 73
<i>Aptenia cordifolia</i> (L.f.) Schwant.	54	<i>Asystasia gangetica</i> (L.) T. Anders (= <i>A. coramandeliana</i> Nees)	14, 17
<i>Aptosimum albomarginatum</i> Marl. & Engl.	73	<i>Atalaya alata</i> (Sim) H. Forbes	30
<i>A. depressum</i> (L.f.) Burch.	66, 67, 91	<i>Atthanasia acerosa</i> (DC.) Harv., B	8, 27
<i>A. marlothii</i> Hiern	40, 42, 43, 73, 77	<i>A. leucoclada</i> (DC.) Harv.	20
<i>A. spinescens</i> (Thunb.) Web.	66, 68, 72, 73, 77	<i>A. linifolia</i> Harv.	86
<i>A. steingroeveri</i> Engl.	66, 68, 69, 77	<i>A. punctata</i> (DC.) Harv.	101
<i>Arctopus</i>	25	<i>A. trifurcata</i> L.	86
<i>Arctotheca populifolia</i> (Berg.) Norl.	17		
<i>Arctotis fastuosa</i> Jacq.	71		
<i>A. leiocarpa</i> Harv.	43		
<i>A. staechadifolia</i> Berg.	67		
<i>Argemone subfusiformis</i> G.B. Ownb., B	72		
<i>Argyroderma</i>	70		
<i>Argyrolobium pauciflorum</i> Eckl. & Zeyh.	104		
<i>A. rupestris</i> Walp.	17		
<i>A. tomentosum</i> (Andr.) Druce	26, 82, 84, 85		

- Athrixia phylicoides* DC. .... 22, 28  
*Atriplex vestita* Thunb. .... 64, 70, 86  
*Augea capensis* Thunb., B. .... 60, 70, 71, 73, 79  
*Australina acuminata* Wedd. .... 82, 85  
*Avicennia marina* (Forsk.) Vierh. .... 17, 18  
*Azima tetracantha* Lam. .... 4, 18, 24, 30, 51, 53, 55, 56, 86  
  
*Babiana hypogaea* Burch. .... 67  
*Balanites maughamii* Sprague .... 28, 46, 48  
*B. pedicellaris* Mildb. & Schirr. .... 48  
*Barleria elegans* S. Moore .... 30  
*B. lichensteiniana* Nees .... 73  
*B. macrostegia* Nees .... 39, 90  
*B. obtusa* Nees .... 53, 54  
*B. rigida* Nees .... 43, 60, 72, 73  
*Bauhinia* .... 4  
*B. esculenta* Burch. .... 99  
*B. galpinii* N.E. Br. .... 24, 27, 28  
*B. garipensis* E. Mey. .... 75  
*B. natalensis* Oliv. .... 53  
*Becium burchellianum* N.E. Br. .... 51, 55, 80  
*B. obovatum* (E. Mey. ex Benth.) N.E. Br. .... 20, 23, 99, 102  
  
*Begonia* sp. .... 26  
*Begonia reticulata* Dindr. .... 17, 18, 19, 26, 82, 84, 85  
*Bequaertiadendron magalismontanum* (Sond.) Heine & Hemsl.  
*B. natalense* (Sond.) Heine & Hemsl. .... 14  
*Berchemia zeyheri* (Sond.) Grubov. .... 30, 49  
*Bergia amagaloides* E. Mey. ex Fenzl. .... 67  
*Berkheyia* .... 51, 89  
*B. annectens* Harv., B. .... 67, 68, 78, 81  
*B. bipinnatifida* (Harv.) Roessl. .... 14, 17, 20, 26  
*B. canescens* DC., G. .... 73  
*B. echinacea* (Harv.) O. Hoffm. ex Burtt Davy .... 102  
*B. fruticosa* (L.) Ehrh. .... 62, 70  
*B. onopordifolia* (DC.) O. Hoffm. ex Burtt Davy, B. .... 89, 90  
*B. rigida* (Thunb.) Bolus & Wolley Dod ex Adams. & Salt. .... 92  
*B. setifera* DC. .... 23, 95, 101  
*B. sp. A. 10117* .... 103  
*B. speciosa* (DC.) O. Hoffm. .... 15  
*B. spinosa* (L.f.) Druce .... 70, 74  
*B. spinosissima* (Thunb.) Willd. subsp. *namaensis* Roessl. .... 72  
*Bersama tynsoniana* Oliv. .... 19, 21, 26  
*Berzelia* .... 105  
*Blackiella inflata* (F.v.Muell.) Aell. .... 70, 71  
*Blaeria* .... 105  
*Blechnum attenuatum* (Swartz) Mett. .... 22, 26, 85  
*B. australe* L. .... 19  
*Blépharis* .... 32  
*B. capensis* (L.f.) Pers., B. .... 61  
*B. integrifolia* (L.f.) E. Mey. .... 81, 104  
*B. natalensis* Oberm. .... 53  
*Blotiella glabra* (Bory) Tryon .... 22  
*Bobartia* .... 107  
*B. gracilis* Bak., B. .... 24, 25  
*Bolusanthus speciosus* (H. Bol.) Harms .... 28, 47  
  
*Bolusia capensis* Benth. .... 39  
*Boophane disticha* Herb. .... 39, 95  
*Boscia* .... 34  
*B. albitrunca* (Burch.) Gilg & Ben., GG .... 32, 34, 35, 37, 38, 39, 40, 41, 72, 73, 74  
*B. foetida* Schinz subsp. *foetida* .... 73, 75  
*B. foetida* Schinz subsp. *rehmanniana* (Pest.) Tölken, GG .... 32, 35, 37, 38, 45, 46, 48  
*B. oleoides* Burch. ex DC. .... 58  
*Borhriochoa glabra* (Roxb.) A. .... 24, 27, 31  
*Camus* ....  
*B. insculpta* (Hochst.) A. Camus, B. .... 29, 30, 31, 32, 33, 36, 38, 48  
*B. radicans* (Lehm.) A. Camus .... 90  
*Brachiaria brizantha* (Hochst. ex A. Rich.) Stapf, G. .... 27  
*B. eruciformis* (Sibth. & J.E. Sm.) Griseb. .... 31, 53  
*B. marlothii* (Hack.) Stent, B. .... 79  
*B. nigropedata* (Munro ex Fical. & Hiern) Stapf .... 29, 31, 32, 34, 35, 38, 44, 45, 46, 48, 49, 50, 104, 105  
*B. serrata* (Thunb.) Stapf var. *gossypina* (A. Rich.) Stapf .... 95  
*B. serrata* (Thunb.) Stapf var. *serrata* .... 16, 17, 23, 24, 27, 29, 42, 48, 83, 84, 86, 87, 88, 90, 92, 94, 95, 99, 100, 111, 103, 104  
*B. sp. cf. B. stolonifera* (Goossens) L. Chippindall, G. .... 29  
*Brachylaena discolor* DC. .... 13, 14, 15, 16, 18, 19, 26  
*B. ilicifolia* (Lam.) Phill. & Schweick. .... 51, 52, 54, 55, 57  
*B. rotundata* S. Moore .... 32, 49  
*Brachypodium flexum* Nees, B. .... 26, 82, 102  
*B. sp. A. 16156*, GG .... 98  
*Bridelia mollis* Hutch. .... 49  
*Bromus*, G. .... 74  
*B. firmior* (Nees) Stapf .... 85, 95, 98  
*B. leptocladus* Nees, GG .... 98  
*B. wildenowii* Kunth .... 98  
*Brownanthus ciliatus* (Ait.) Schwant., B. .... 60, 61, 65, 68, 71, 80  
*Bryonia gymorrhiza* (L.) Lam. .... 17, 18  
*Brunia* .... 105  
*Brunsvigia* .... 105  
*Buddleia auriculata* Benth. .... 100  
*B. corrugata* (Benth.) Phill. .... 97  
*B. dysphylla* (Benth.) Radlk. .... 22, 103  
*B. glomerata* Wendl.f. .... 58, 63  
*B. pulchella* N.E.Br. .... 22  
*B. saligna* Willd. .... 41, 42, 43, 50, 51, 53, 63, 86, 90, 103  
*B. salviifolia* Lam. .... 26, 27, 82, 95, 97, 99  
*Bulbinella* .... 105  
*Bulbostylis* .... 25, 83, 95  
*B. burchellii* C.B.Cl. .... 39, 48, 99  
*Burchellia bulbalina* (L.f.) Sims .... 14, 19, 26, 84, 85  
*Burkea* .... 44, 45, 46, 47  
*B. africana* Hook. .... 14, 44, 45, 46, 49, 50  
*Buxus macowanii* Oliv. .... 14, 54  
*B. natalensis* (Oliv.) Hutch. .... 14  
  
*Cadaba aphylla* (Thunb.) Wild. .... 34, 42, 55, 57, 61, 72, 73, 79  
*C. natalensis* Sond. .... 24, 28  
*C. termitaria* N.E. Br. .... 38, 47  
*Caesalpinia decapetala* (Roth.) Als. .... 27  
*Calodendrum* .... 13  
*C. capense* Thunb. .... 21, 82, 84, 85  
*Calpurnia aurea* (Ait.) Benth. subsp. *aurea* .... 14, 52, 82, 103  
*C. aurea* (Ait.) Benth. subsp. *svilatrica* (Burch.) Brummitt .... 28, 84  
*C. intrusa* E. Mey. .... 103  
*C. woodii* Schinz .... 103  
*Campylostachys* .... 105  
*Canthium ciliatum* (Klotzsch) Kuntze .... 14, 82, 84, 85, 103  
*C. gueinzii* Sond. .... 26, 85  
*C. mundianum* Cham. & Schlecht. .... 13, 15, 16, 19, 85  
*C. obovatum* Klotzsch .... 16, 18, 54  
*C. pauciflorum* Klotzsch .... 82, 84  
*C. spinosum* (Klotzsch) Kuntze, B. .... 18, 26, 53  
*C. ventosum* (L.) S. Moore .... 18, 51, 84  
*Capparis* .... 58  
*C. fascicularis* DC. var. *zeyheri* (Turcz.) Tölken .... 18  
*C. oleoides* Burch., GG .... 51, 55, 57, 58  
*C. sepiaria* L. var. *citrifolia* (Lam.) Tölken .... 18, 30, 51, 53, 55, 56  
*C. tomentosa* Lam. .... 33, 28, 30  
*C. transvaalensis* Schinz var. *calvescens* .... 18  
*Caralluma inversa* N.E. Br. .... 71  
*C. winkleri* (Dinter) White & Sloane .... 70, 74  
*Carex spicato-paniculata* C.B.Cl. .... 26, 85  
*Carissa bispinosa* (L.) Desf. ex Brennan .... 14, 18, 19, 26, 37, 49, 50, 54, 56, 82, 84, 85  
*C. haematocarpa* (Eckl. & Zeyh.) A.D.C. .... 51, 55, 58, 59, 60, 61, 86  
*Casearia gladiiformis* Mast. .... 13, 22  
*Cassia abbreviata* Oliv. subsp. *beareana* (Holmes) Brennan .... 30, 38  
*C. mimosoides* L., B. .... 15, 20, 23, 24, 39, 99, 103  
*C. nigrescens* Vahl .... 39, 40  
*C. sp.* .... 14  
*Cassine aethiopica* Thunb. .... 13, 16, 18, 19, 30, 51, 52, 53, 56  
*C. burkeana* (Sond.) Kuntze .... 49, 50  
*C. crocea* (Thunb.) Kuntze .... 18  
*C. papillosa* (Hochst.) Kuntze .... 13, 51, 84  
*C. peragua* L. .... 18, 56, 87  
*C. spp.* .... 16, 24, 51  
*C. tetragona* (L.f.) Loes. .... 17, 18, 26, 54, 57, 86  
*C. transvaalensis* (Burtt Davy) Codd .... 28  
*Cassinopsis ilicifolia* (Hochst.) Kuntze .... 26, 82, 84, 85, 99, 103  
*C. timifolia* Harv. .... 19  
*Cassipourea gerrardii* (Schinz) Alston .... 26  
*C. gunnifluia* Tul. var. *verticillata* (N.E.Br.) J. G. Lewis .... 13, 19, 22, 85

<i>Castalis spectabilis</i> (Schltr.) Norl., P	99	<i>Cnestis natalensis</i> (Hochst.) Planch. & Sond.	14, 19, 22, 26, 84
<i>Catophractes alexandri</i> D. Don	35, 38	<i>Cocculus hirsutus</i> (L.) Diels	29
<i>Celtis</i>	13	<i>Codon royenii</i> L.	72
<i>C. africana</i> Burm. f.	13, 19, 21, 32, 42, 50, 63, 82, 84, 85, 90, 95, 97, 99, 103	<i>Coleonema</i>	107
<i>Ceuchrus ciliaris</i> L., G	32, 33, 35, 38, 42, 43, 48, 58, 60, 72, 73	<i>Coleus neochilus</i> (Schltr.) L.E. Codd	37
<i>Centella asiatica</i> (L.) Urb.	14, 20, 22, 23, 26, 84	<i>Cophospernum mopane</i> (Kirk ex Benth.) Kirk ex J. Léon	30, 37, 38
<i>C. glabrata</i> L. var. <i>natalensis</i> Adamson	20	<i>Combretum</i>	30, 44, 46
<i>Cephaelanthus natalensis</i> Oliv.	100	<i>C. apiculatum</i> Sond.	28, 29, 30, 33, 35, 38, 44, 45, 46, 47, 48, 49
<i>Cephalaria attenuata</i> (L.f.) Roem. & Schult.	15, 23	<i>C. collinum</i> Fresen. subsp. <i>sultuense</i> (Engl. & Diels) Okafor	27
<i>Cephalophyllum curtophyllum</i> Schwart.	61, 70, 71	<i>C. erythrophylloides</i> (Sond.) Burch.	36
<i>C. pittieri</i> L. Bol.	70	<i>C. hereroense</i> Schinz	28, 32, 47, 49
<i>C. spongiosum</i> L. Bol.	70	<i>C. inerberae</i> Wawra	30, 37, 44, 46
<i>C. vandermerwei</i> L. Bol.	61	<i>C. kraussii</i> Hochst.	13, 14, 19, 20, 21, 22, 23, 26, 85, 102
<i>Ceraria namaquensis</i> (Sond.) Pearson	74	<i>C. mollis</i> R. Br. ex G. Don	15, 23, 24, 32, 48, 49, 53
<i>Cerochlamys pachyphylla</i> (L. Bolus) L. Bol.	61	<i>C. zeyheri</i> Sond.	27, 45, 46, 49
<i>Ceropegia implicata</i> Oberm.	19	<i>Cominella africana</i> L.	23, 40, 91
<i>C. scabiflora</i> N.E. Br.	102	<i>C. benghalensis</i> L.	17, 19, 37
<i>Cestrum laevigatum</i> Schltr., BB.	14	<i>Commiphora</i>	4, 34, 35, 38, 46
<i>Chaetacanthus setiger</i> (Pers.) Lindl.	17, 53	<i>C. graciliflora</i> Dinter ex V. der Walt	73, 75
<i>Chaetaea aristata</i> Planch.	13, 19, 30, 50, 53	<i>C. harveyi</i> (Engl.) Engl.	24, 103
<i>Chaetobromus dregeanus</i> Nees, GG	74, 76	<i>C. mollis</i> (Oliv.) Engl. (= <i>C. welwitschii</i> Engl.)	48
<i>C. schraderi</i> Stapf, GG.	70	<i>C. pyracanthoides</i> Engl.	32, 33, 34, 35, 38, 48
<i>Chascanum garipense</i> E. Mey.	72	<i>C. schimperi</i> (O. Berg) Engl.	28
<i>C. latifolium</i> (Harv.) Mold.	102	<i>C. zanzibarica</i> (Baill.) Engl.	24, 103
<i>C. pinnatifidum</i> (L.f.) E. Mey.	72	<i>Conicosia alba</i> L. Bolus, MS	70
<i>Chasmatomphylgium musculinum</i> (Haw.) DC. & Schwart.	98	<i>Conophytum calculus</i> (Berger) N.E. Br.	70
<i>Cheilanthes bergiana</i> Schlechtd.	22, 84	<i>C. minutum</i> (Haw.) N.E. Br.	70
<i>C. eckloniana</i> (Kuntze) Mett.	98	<i>C. petraeum</i> N.E. Br.	61
<i>C. hirta</i> Swartz	98	<i>C. wettsteinii</i> (Berger) N.E. Br.	70
<i>Cheiridopsis cuprea</i> (L. Bol.) N.E. Br.	70	<i>Conostomium natalense</i> (Hochst.) Brem.	19, 22, 23, 24, 26, 85
<i>C. denticulata</i> (Haw.) N.E. Br. var.	70	<i>Conzya ivaefolia</i> (L.) Less.	86
<i>denticulata</i>		<i>C. piunata</i> (L.f.) Kuntze.	88
<i>Chenopodium stellatum</i> (Benth.) Aell.	98	<i>Corbicchia decumbens</i> (Forsk.) Exell	72
( <i>Chilianthus</i> ) see <i>Buddleia</i>		<i>Cordia caffra</i> Sond.	15, 16, 18, 30
<i>Chloris gayana</i> Kunth, GG	14, 24, 36	<i>Corymbium</i>	105
<i>C. roxburghiana</i> Schult., GG	38	<i>C. africanum</i> L.	25
<i>C. virgata</i> Swartz, B	69, 71, 79, 89	<i>Cotyledon</i>	74, 98
<i>Chlorophyllum</i>	85	<i>C. decussata</i> Sims	42, 61, 70
<i>Choristylis rhamnooides</i> Harv.	85	<i>C. orbiculata</i> L., P	17, 57, 59
<i>Chrysanthemoïdes</i>	20, 105	<i>C. paniculata</i> L.f.	61, 62, 66, 74, 75
<i>C. monilifera</i> (L.) Norl.	16, 17, 18, 19, 86, 87	<i>C. ramosissima</i> Mill.	55, 59
<i>Chrysanthemum carnosulum</i> DC.	86	<i>C. reticulata</i> Thunb.	61, 71
<i>Chrysithrix</i>	105	<i>C. velutina</i> Hook. f.	18
<i>Chrysocoma</i>	3, 4	<i>C. ventricosa</i> Burm.	70
<i>C. coma aurea</i> L.	74	<i>C. wallichii</i> Harv., P	62, 64, 66, 70, 71, 74, 81
<i>C. longifolia</i> DC.	70	<i>Crabea acaulis</i> N.E. Br.	89
<i>C. sp., A. 6812 H</i>	43	<i>C. angustifolia</i> Nees	99
<i>C. tenuifolia</i> Berg., BB	39, 40, 43, 50, 55, 59, 60, 63, 64, 65, 71, 72, 78, 80, 81, 86, 89, 91, 97, 98	<i>C. hirsuta</i> Harv.	23
<i>Chrysopogon</i>	42	<i>Crassula</i>	57, 71, 74, 98
<i>C. serrulatus</i> Trin.	34, 41	<i>C. acutifolia</i> Lam.	57
<i>Cissampelos torulosa</i> E. Mey.	14, 19, 26, 82, 84, 85	<i>C. brevifolia</i> Harv.	74, 70
<i>Cissus diversilobata</i> C.A. Sm.	102	<i>C. corallina</i> Thunb.	98
<i>C. fragilis</i> E. Mey.	14, 17, 19	<i>C. cordata</i> Thunb.	54, 55
<i>C. quadrangularis</i> L.	28, 30	<i>C. cornuta</i> Schonl. & Bak. f.	71
<i>C. sp., A. 13094</i>	28, 30	<i>C. cultivata</i> L.	55, 57, 59
<i>Cladostemon kirkii</i> (Oliv.) Pax	28, 30	<i>C. expansa</i> Dryand.	57
<i>Clausena anisata</i> (Willd.) Hook. f.	14, 15, 17, 18, 24, 26, 82, ex Benth.	<i>C. globosa</i> N.E. Br.	70
<i>C. tenuifolia</i> Berg., BB	85, 103	<i>C. lactea</i> (Dryand.) Ait.	55
<i>Clematis</i>	18, 63	<i>C. lycopodioides</i> Harv. & Schonl.	55, 57, 59, 86, 70
<i>C. brachiata</i> Thunb.	22, 82	<i>C. mesembryanthoides</i> (Haw.) Dietr.	55, 57
<i>Clematopsis scabiosifolia</i> (DC.) Hutch.	99	<i>C. multicava</i> Lem. & Verschoff	54
<i>Cleome diandra</i> Burch.	72, 73	<i>C. obvallata</i> L.	59, 70
<i>Clerodendrum glabrum</i> E. Mey.	14, 15, 16, 18, 19, 23, 24, 26, 32, 47, 50	<i>C. perforata</i> L.	59
<i>Cliffortia</i>	8, 105, 107	<i>C. perforata</i> Thunb.	54, 55, 57, 59
<i>C. linearifolia</i> Eckl. & Zeyh., B	24, 27, 50, 84, 85	<i>C. portulacea</i> Lam.	55, 56, 58, 61
<i>C. nitida</i> (Engl.) Rob. E. & Th. Fr.	97	<i>C. rogersii</i> Schonl.	59
jr. subsp. <i>pilosus</i> Weim.		<i>C. rupestris</i> Thunb.	55, 59, 61
<i>C. paucistaminea</i> H. Weim., BB	84, 85	<i>C. sessiliflora</i> Mogg	37
<i>C. ramossissima</i> Schltr.	97, 98	<i>C. spatulata</i> Thunb.	57
<i>C. repens</i> Schltr., B	8	<i>C. subsessilis</i> Bak.	61
<i>C. sp., A. 15906</i>	98	<i>C. tetragona</i> L.	55, 59
<i>C. strobilifera</i> Murr.	20	<i>C. transvaalensis</i> (Kuntze) K. Schum.	37
<i>C. tuberculata</i> (Harv.) H. Weim.	98	<i>C. turrita</i> Thunb.	104
<i>Clivia</i> sp., <i>Codd 1655</i>	26	<i>Crotalaria capensis</i> Jacq.	19
<i>Clitellaria hirsuta</i> E. Mey. ex Sond.	22	<i>C. laburnifolia</i> L.	29
<i>C. polifolia</i> Jacq.	98	<i>C. virguliflora</i> Burch.	40
<i>C. pulchella</i> L.	19, 22, 82, 84, 90, 95, 97	<i>Croton</i>	41, 42, 43, 47
		<i>C. gratissimus</i> Burch.	32, 41, 42, 49
		<i>C. rivularis</i> Muell. Arg.	18, 54
		<i>C. sylvaticus</i> Hochst.	13, 14, 16, 19, 20, 22, 23
		<i>Cryptadenia</i>	105

- Cryptocarya latifolia* Sond. .... 13, 14, 19  
*C. woodii* Engl. .... 13, 19, 21, 22, 23, 82, 84  
*C. wyliei* Stapf .... 19  
*Ctenium concinnum* Nees .... 20, 27, 95, 100, 101  
*Ctenomera capensis* (Thunb.) Harv. ex Sond. .... 17, 19, 26  
*Cullumia* .... 105  
*Cunonia capensis* L. .... 22, 85  
*Curroria decidua* Planch. ex. Hook. f. & Benth. .... 73, 75  
*Curtisia dentata* (Burm. f.) C.A. Sm. .... 18, 21, 26, 84, 102  
*Cuspidia cernua* (L.f.) B.L. Burtt, B  
*Cussonia kraussii* Hochst. .... 15  
*C. natalensis* Sond. .... 23, 24, 28  
*C. paniculata* Eckl. & Zeyh. .... 32, 63, 90, 100  
*C. sp.* .... 13  
*C. spicata* Thunb. .... 13, 18, 19, 21, 23, 24, 26, 47, 51, 53, 54, 55, 56, 57, 80, 84, 85, 86, 90, 100, 103  
*C. thrysiflora* Thunb. .... 18, 75  
*Cyanella* .... 105  
*Cyanotis speciosa* (L.f.) Hassk. .... 37, 54, 99, 104  
*Cyathula cylindrica* Moq. .... 14, 26  
*Cyclopia* .... 105  
*Cynium adonense* E. Mey. .... 99  
*Cylindrophyllum calaniforme* (L.) Schwant.  
*Cymbopogon* .... 1, 5, 8, 31, 95, 39, 51, 80, 88, 89, 90, 91, 92, 93, 94  
*C. excavatus* (Hochst.) Stapf ex Burtt Davy, B .... 14, 23, 24, 27, 29, 42, 48, 90, 92, 99, 100, 101, 103, 104  
*C. marginatus* (Steud.) Stapf ex Burtt Davy .... 17, 24, 95  
*C. plurinodus* (Stapf) Stapf ex Burtt Davy, B .... 16, 29, 30, 31, 32, 33, 34, 35, 39, 41, 42, 43, 47, 48, 49, 51, 52, 53, 56, 63, 73, 74, 81, 86, 87, 88, 89, 90, 91, 92, 93, 94, 97, 98, 99, 103, 104  
*C. prolixus* (Stapf) Phill. .... 98  
*C. validus* (Stapf) Stapf ex Burtt Davy .... 14, 16, 20, 22, 23, 24, 27, 54, 102  
*Cynanchum ellipticum* (Harv.) R.A. Dyer .... 16, 18, 53, 57, 75  
*C. obtusifolium* L.f. .... 87  
*Cynodon dactylon* (L.) Pers. .... 17, 24, 25, 39, 53, 54, 88, 90, 100, 103  
*C. incompletus* Nees .... 40, 53, 57, 69, 88, 89, 104  
*Cyperus* .... 26  
*C. albostriatus* Schrad. .... 14, 19, 22, 26, 53, 54, 82, 84, 85  
*C. margaritaceus* Vahl .... 39, 99  
*C. obtusiflorus* Vahl var. *flavissimum* Boeck. .... 85  
*C. obtusiflorus* Vahl var. *obtusiflorus* .... 20, 24  
*C. semirifidus* Schrad. .... 37, 90  
*C. teneriffae* Poir. .... 37  
*C. usitatus* Burch. .... 79, 81, 82, 104  
*Cyphia comptonia* Bond .... 71  
*C. elata* Harv. .... 20  
*C. sylvatica* Eckl. .... 59  
*Cyphocarpa angustifolia* Lopr. .... 73  
*Cypholepis yemenica* (Schweinf.) Chiov.  
*Cyphostemma spinosopilosum* (Gilg & Brandt) Desc. .... 102  
*C. woodii* (Gilg & Brandt) Desc. .... 22  
*Dactyloctenium australe* Steud. .... 14, 17, 19  
*Dactyloctenium digitata* (Ait.) N.E. Br. .... 70  
*Dais confinifolia* L. .... 82, 101, 103  
*Dalbergia armata* E. Mey. .... 15, 23, 27  
*D. melanoxylon* Guill. & Perr. .... 30  
*D. multiflora* E. Mey. .... 14, 23  
*D. obovata* E. Mey. .... 14, 16, 19, 23, 26, 27, 52, 54, 84, 85, 101  
~~(=Danthonia disticha)~~ *Merxmuellera disticha* (Nees) Conert, *Deinbollia oblongifolia* (E. Mey. ex Arn.) Radlk.  
*Delosperma* .... 4, 37, 98  
*D. ecklonis* (Salm) Schwant. .... 54, 57  
*D. frutescens* L. Bol. .... 59  
*D. multiflora* L. Bol. .... 69, 71  
*D. pageanum* (L. Bol.) L. Bol. .... 61  
*D. sp., A. 16279* .... 97  
*D. subincanum* (Haw.) Schwant. .... 60, 62, 68  
*Desmodium caffrum* (E. Mey.) Druce .... 15, 20  
*D. repandum* (Vahl) DC. .... 14, 26  
*Deverra aphylla* (Cham. & Schlechtd.) DC. .... 71  
*Dianthus caespitosus* Thunb. subsp. *caespitosus* .... 98  
*Diascia capsularis* Benth. .... 98  
*D. engleri* Diels .... 67  
*Dichanthium papillosum* (Hochst. ex A. Rich.) Stapf .... 32, 36  
*Dichapetalum* .... 44  
*D. cymosum* Engl., P. .... 44, 45  
*Dichrostachys* .... 33, 37, 39  
*D. cinerea* (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt .... 8, 23, 24, 27, 28, 31, 32, 34, 35, 37, 38, 39, 44, 46, 47, 48, 49  
*D. cinerea* (L.) Wight & Arn. subsp. *nyassana* (Taub.) Brenan .... 29  
*Dicliptera capensis* Nees .... 57  
*D. clinopodia* Nees .... 14  
*D. quintii* Lindau .... 85  
*Dicoma anomala* Sond. .... 95, 99, 100, 101, 103  
*D. capensis* Less. .... 66, 68, 72  
*D. macrocephala* DC. .... 90  
*D. selinii* O. Hoffm. .... 39, 40  
*D. spinosa* Druce, (=*D. burmannii* Less.) .... 60, 61, 86  
*Dicranopteris linearis* (Burm. f.) Underw.  
*Dicrocaulon trichotomum* (Thunb.) N.E. Br.  
*Didelia carnosia* (L.f.) Ait. .... 70  
*D. spinosa* (L.f.) Ait. .... 74, 82  
*Dierama reynoldsi* Verdoorn .... 20  
*Digitaria* .... 5, 14, 16, 20, 24, 29, 30, 31, 32, 34, 36, 42, 45, 46, 51, 69, 73, 97  
*D. argyrograppa* (Nees) Stapf, G. .... 31, 55, 56, 57, 58, 60, 64, 71, 81, 88, 89, 90, 91, 92, 104  
*D. brazzae* (Franch) Stapf .... 100  
*D. diagonalis* (Nees) Stapf .... 20, 23, 24, 86, 92  
*D. eriantha* Steud, G. .... 25, 29, 30, 32, 33, 34, 38, 39, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 53, 58, 60, 87, 88, 90, 99, 108  
*D. littoralis* Stent, G. .... 17, 24, 87  
*D. longiflora* Pers. .... 53  
*D. monodactyla* (Nees) Stapf, B. .... 25, 27, 49, 83, 85, 88, 94, 99, 100, 103  
*D. smutsii* Stent, G. .... 42, 72  
*D. swazilandensis* Stent. .... 24  
*D. tricholaenoides* Stapf, B. .... 27, 29, 86, 87, 94, 95, 99, 100, 101, 103  
*Diheteropogon amplexens* (Nees) Clayton .... 14, 16, 17, 20, 23, 24, 27, 29, 42, 50, 83, 86, 88, 94, 95, 99, 100, 101, 103  
*D. filifolius* (Nees) Clayton. .... 20, 23, 27, 83, 86, 95, 96, 100, 101, 103  
*Dilatris* .... 105  
*Dimorphotheca cuneata* (Thunb.) Less., B. .... 81, 98  
*D. polyptera* DC. .... 67, 68  
*D. zeyheri* Sond. .... 79  
*Dinocanthium hystrix* Brem. .... 16, 30  
*Diodia natalensis* (Hochst.) Garcia .... 20, 23, 86  
*Dioscorea cotinifolia* Kunth .... 19, 26, 53, 85  
*D. dregeana* Bak. .... 14, 19, 26, 85  
*Diosma* .... 105  
*D. eckloniana* Sond. .... 4  
*Diospyros austro-africana* De Wint. var. *austro-africana* .... 95, 97, 98  
*D. austro-africana* De Wint. var. *microphylla* (Burch.) De Wint. .... 41  
*D. galpinii* (Hiern) De Wint. .... 23, 27, 102  
*D. glabra* (L.) De Wint. .... 87  
*D. glandulifera* De Wint. .... 28, 75  
*D. lycioides* Desf. subsp. *lycioides* .... 18, 53, 59, 86  
*D. lycioides* Desf. subsp. *sericea* (Bernh.) De Wint. .... 49  
*D. mespiliformis* Hochst. .... 27, 30  
*D. pallens* (Thunb.) F. White .... 15, 36, 39, 41, 43, 60, 63, 69, 90, 101  
*D. scabrida* (Harv. ex Hiern) De Wint. var. *cordata* (E. Mey. ex A.D.C.) De Wint. .... 19, 26, 54, 55, 59, 84, 101  
*D. simii* (Kuntze) De Wint. .... 14, 53  
*D. villosa* (L.) De Wint. .... 18, 19, 22, 84  
*D. whyteana* (Hiern) F. White .... 26, 32, 82, 84  
*Dipcadi* .... 67  
*D. glaucum* Bak., P. .... 34, 40  
*Dipidax* .... 105

- Diplachne biflora* Hack. .... 24, 27, 50, 99, 100  
*D. eleusine* Nees ..... 29, 30, 53  
*D. fusca* Beauv., G ..... 36, 79, 92  
*Diphorhynchus condylocarpon* (Muell. Arg.) Pichon  
*Dipogon lignosus* (L.) Verdc. .... 75  
*Disa* ..... 105  
*Disparago ericoides* Gaertn. .... 25  
*Dissotis princeps* (Bonpl.) Triana ..... 27  
*Dodonaea viscosa* Jacq. var. *angustifolia* Benth. .... 58, 59, 62, 63, 74  
*Dolichos angustifolius* Eckl. & Zeyh. .... 16  
*D. lablab* L. .... 16  
*Dombeya cymosa* Harv. .... 52, 103  
*D. rotundifolia* (Hochst.) Planch. .... 23, 27, 28, 32, 45, 48, 49  
*Doryopteris concolor* (Langsd. & Fisch.) Kuhn  
*Dovyalis* ..... 84  
*D. caffra* (Hook.f. & Harv.) Hook. f. .... 24  
*D. rhamnoides* (Burch. ex DC.) Harv. .... 14, 17, 18, 22, 82  
*D. zeyheri* (Sond.) Warb. .... 49, 50  
*Dracaena* ..... 12, 23  
*D. hookeriana* Koch ..... 14, 16, 19, 23, 26  
*Drosanthemum ambiguum* L. Bol. .... 64, 68  
*D. bredai* L. Bol. .... 62  
*D. deliciatum* (L. Bol.) Schwant. .... 62  
*D. diversifolium* L. Bol. .... 70  
*D. eburneum* L. Bol., B ..... 65, 70, 71  
*D. fourcadei* (L. Bol.) Schwant. .... 57, 71  
*D. framesii* L. Bol., B ..... 60, 68, 69, 80  
*D. hispidum* (L.) Schwant. .... 62, 80  
*D. lique* (N.E.Br.) Schwant., G ..... 56, 60, 62, 63, 64, 68, 69, 71, 80  
*D. speciosum* (Haw.) Schwant. .... 62  
*D. subalatum* L. Bol. .... 70  
*Duranta repens* L. .... 27  
*Duvernoia adhatodioides* E. Mey. ex Nees  
*Dyerophytum africanum* (Lam.) Kuntze ..... 72, 74  
*Dyschoriste* ..... 32  
*D. rogersii* S. Moore ..... 29  
*Eberlanzia vulnerans* (L. Bol.) L. .... 51, 64, 69, 71  
*Bol., B*  
*Echinochloa holubii* Stapf, GG ..... 36, 79, 92  
*Echinus geminatus* (Harv.) L. Bol. .... 71  
*Echiostachys* ..... 105  
*Elvretia rigida* (Thunb.) Druce ..... 18, 24, 30, 40, 41, 43, 48, 51, 53, 54, 55, 56, 72, 90  
*Ehrharta* ..... 86, 87, 97, 105  
*E. aphylla* Schrad., G ..... 86  
*E. calycina* Sm., G ..... 17, 24, 58, 59, 62, 63, 64, 70, 74, 76, 81, 86, 98  
*E. erecta* Lam. ..... 17, 22, 26, 54, 82, 84  
*E. villosa* Schult., G ..... 76  
*Ekebergia capensis* Sparrm. .... 13, 19, 23, 24  
*E. pterophylla* (C.D.C.) Hofmeyr ..... 101  
*Elephantorrhiza burkei* Benth. .... 49  
*E. elephantina* (Burm.) Skeels ..... 27, 39, 40, 99  
*Elionurus* ..... 44, 100, 103  
*E. argenteus* Nees ..... 16, 17, 24, 25, 27, 29, 31, 32, 39, 42, 44, 48, 49, 50, 51, 83, 84, 85, 88, 89, 90, 91, 92, 94, 95, 97, 98, 99, 100, 101, 102, 103, 104  
*Elytropappus* ..... 4, 8, 86, 98, 105, 107  
*E. rhinocerotis* Less., BB ..... 24, 25, 59, 62, 81, 82, 98, 106  
*Encephalartos ghelliinkii* Lem. .... 97  
*E. lehmannii* Lehmann ..... 59  
*Endostemon obtusifolius* (E. Mey. ex Benth.) N.E. Br.  
*Enneapogon* ..... 3, 41, 66, 71  
*E. cenchroides* Hubb. ..... 38, 60  
*E. desvauxii* Beauv., GB ..... 41, 43, 60, 62, 64, 66, 67, 68, 69, 79  
*E. pretoriensis* Stent ..... 50  
*E. scaber* Lehmann ..... 60, 62, 67, 73, 74  
*E. scoparius* Stapf ..... 30, 31, 32, 33, 34, 35, 37, 39, 42, 43, 58, 63, 73, 90  
*Entada spicata* (E. Mey.) Druce ..... 14, 19, 23, 85  
*Eragrostis* ..... 3, 24, 32, 34, 40, 43, 44, 45, 48, 49, 78  
*E. annulata* Rendle ex Scott Elliot ..... 67, 73  
*E. bergiana* (Kunth) Trin., G ..... 64, 78, 81  
*E. bicolor* Nees, G ..... 43, 60, 64, 69, 79, 81, 92  
*E. brizantha* Nees ..... 73
- E. caesia* Stapf ..... 95  
*E. capensis* (Thunb.) Trin. .... 16, 20, 23, 24, 28, 83, 84, 86, 87, 88, 89, 92, 94, 95, 97, 99, 100, 102, 103, 104  
*E. chloromelas* Steud. .... 17, 24, 31, 32, 39, 49, 51, 52, 54, 56, 59, 63, 78, 81, 85, 88, 89, 90, 91, 92, 94, 95, 96, 97, 98, 99, 100, 102, 103, 104  
*E. curvula* (Schrad.) Nees ..... 23, 29, 42, 50, 51, 53, 58, 59, 64, 71, 73, 86, 87, 89, 92, 95, 97, 98, 100, 103, 104  
*E. cyperoides* (Thunb.) Beauv. .... 75  
*E. echinochloidea* Stapf ..... 73  
*E. gummiflua* Nees, B ..... 29, 39, 49, 88, 90, 99, 100, 103  
*E. homomalla* Nees ..... 67  
*E. lapula* Nees ..... 29  
*E. lehmanniana* Nees, GB ..... 35, 39, 40, 41, 42, 58, 60, 63, 64, 69, 71, 72, 73, 77, 78, 79, 81, 88, 89, 90, 91  
*E. micrantha* Hack. ..... 92  
*E. nindensis* Fical. & Hiern ..... 38, 50, 64, 66, 67, 73  
*E. obtusa* Munro ex Fical. & Hiern, GB ..... 37, 40, 51, 56, 57, 58, 60, 64, 71, 78, 79, 80, 88, 89, 91, 92, 104  
*E. pallens* Hack., B ..... 34, 39, 44, 45  
*E. patentissima* Hack. ..... 95  
*E. plana* Nees, B ..... 14, 16, 23, 24, 25, 27, 83, 84, 85, 86, 88, 89, 92, 93, 94, 95, 100, 101, 103  
*E. planiculmis* Nees ..... 103  
*E. porosa* Nees ..... 60, 67, 73  
*E. procumbens* Nees ..... 60  
*E. racemosa* (Thunb.) Steud. .... 14, 20, 23, 24, 27, 28, 44, 83, 85, 86, 88, 92, 94, 95, 98, 99, 100, 101, 103, 104  
*E. rigidior* Pilg. ..... 105  
*E. rotifera* Rendle ..... 36, 60  
*E. sclerantha* Nees ..... 29, 95, 99, 100, 103  
*E. sp., A.* 14327 ..... 60  
*E. sp., cf. E. curvula* (Schrad.) Nees ..... 27  
*E. sp., cf. E. heteromera* Stapf ..... 49  
*E. sp., cf. E. planiculmis* Nees ..... 16  
*E. sp., cf. E. tricopliora* Coss. & Dur. .... 29, 30, 31, 34, 38, 39, 44, 45, 46, 47, 48  
*E. spinosa* (L.f.) Trin. ..... 4, 62, 71  
*E. superba* Peyr. ..... 16, 29, 30, 31, 34, 36, 38, 39, 44, 48, 49, 50, 53, 89, 90, 104, 105  
*E. tricophora* Coss. & Dur. .... 34, 39, 40, 49, 79, 90  
*E. truncata* Hack. ..... 77  
*Erica* ..... 3, 8, 96, 105, 107  
*E. alopecurus* Harv. ..... 101  
*E. brownleeae* H. Bol. .... 84, 85  
*E. caffra* L. ..... 4, 84, 97, 98  
*E. cerithoides* L. ..... 101  
*E. drakensbergensis* Guth. & Bol. .... 27, 50, 97  
*E. ebracteata* H. Bol. .... 97  
*E. glumaeflora* Klotzsch ex Benth. .... 25  
*E. oatesii* Rolfe ..... 101  
*E. thodei* Guth. & Bol. .... 97  
*E. woodii* H. Bol. .... 27, 97  
*Eriopephalus* ..... 3, 82, 105  
*E. africanus* L. ..... 56, 59, 74, 81  
*E. capitellatus* DC. ..... 59  
*E. ericoides* (L.f.) Druce ..... 40, 43, 58, 60, 61, 63, 64, 67, 68, 69, 71, 73, 74  
*E. eximius* DC. ..... 98  
*E. pubescens* DC. ..... 60, 63, 64, 66, 72, 73  
*E. punctulatus* DC. ..... 81, 97, 98  
*E. racemosus* L. ..... 76, 87  
*E. sp., A.* 12634 ..... 67, 68  
*E. sp., A.* 14407 ..... 64  
*E. spinescens* Burch. ..... 60, 63, 66, 67, 68, 69, 71, 73, 77  
*E. xerophilus* Schltr. ..... 65  
*Eriochloa meyerana* (Nees) Pilg., G ..... 24  
*Eriosema burkei* Benth. ..... 102  
*E. kraussianum* Meisn. ..... 24, 83  
*E. salignum* E. Mey. ..... 102  
*E. squarrosum* Walp. ..... 15, 17, 20, 23, 24  
*Eriospermum* ..... 67  
*Erythrina caffra* Thunb. ..... 13, 16, 23  
*E. latissima* E. Mey. ..... 23  
*E. zeyheri* Harv. ..... 102

- Erythrophysa alata* (Eckl. & Zeyh.) Hutch. 74  
*Erythroxylum pictum* E. Mey. 13  
*Eucalyptus* spp. 86  
*Euclea crispa* (Thunb.) Guerke var. *crispa* 28, 32, 47, 49, 50, 53, 90, 95, 103  
*E. crispa* (Thunb.) Guerke var. *ovata* (Burch.) De Wint. 41, 42, 72  
*E. divinorum* Hiern 30  
*E. natalensis* A. DC. 15, 16, 18, 22, 23, 24, 82, 85  
*E. pseudoebenus* E. Mey. ex A. DC. 75  
*E. racemosa* Murr. 18, 75, 86, 87  
*E. schimperi* (A. DC.) Dandy var. *daphnoides* (Hiern) De Wint. 16, 18, 30, 53, 54  
*E. tomentosa* E. Mey. ex A. DC. 62, 74, 75, 87  
*E. undulata* Thunb. 16, 18, 30, 32, 34, 37, 39, 42, 47, 48, 51, 53, 54, 55, 56, 58, 59, 60, 61, 62, 72, 74, 80, 86, 87  
*Eugenia albanensis* Sond. 20  
*E. capensis* (Eckl. & Zeyh.) Harv. 16, 18  
*E. zuluensis* Duemmer 84  
*Eulalia* 103  
*E. villosa* (Thunb.) Nees 3, 14, 17, 20, 23, 24, 27, 83, 85, 100, 101, 102  
*Eumorphia* 8  
*E. corymbosa* Phill. 98  
*E. dregeana* DC. 98  
*Euphorbia* 43, 52, 54, 57  
*E. aequoris* N.E. Br. 63  
*E. aggregata* Berg. 98  
*E. arida* N.E. Br. 60  
*E. avasmontana* Dinter 42, 71, 72, 73, 74  
*E. bothae* Lotsy and Godd. 55, 56, 58  
*E. burmannii* E. Mey. ex Boiss. 57, 61, 62, 70, 74, 75, 76, 86  
*E. clandestina* Jacq. 86  
*E. clava* Jacq. 57  
*E. clavarioides* Boiss. 3  
*E. coeruleocephala* Haw. 57  
*E. confinalis* R.A. Dyer 28, 29  
*E. cooperi* N.E. Br. ex Berger 28, 46, 48  
*E. curvirana* R.A. Dyer 56  
*E. decussata* E. Mey. ex Boiss. 66, 70, 71  
*E. dregeana* E. Mey. ex Boiss. 73, 74  
*E. epicyparissias* E. Mey. ex Boiss. 20, 97  
*E. evansii* Pax 16, 23, 30  
*E. excelsa* White, Dyer & Sloane 46  
*E. ferox* Marloth 58  
*E. garipiniana* Boiss. 73  
*E. glanduligera* Pax 72  
*E. grandicornis* Goebel ex N.E. Br. 16, 30, 54  
*E. grandidens* Haw. 16, 56, 58  
*E. gummifera* Boiss. 75  
*E. hamata* (Haw.) Sweet 60, 67, 90  
*E. inequilatera* Sond. 71  
*E. inermis* Mill. 16, 23, 27, 28, 30, 46, 48, 49, 50, 52  
*E. kraussiana* Bernh. 18, 22, 85  
*E. ledienii* Berg. 56  
*E. loricate* Lam. 70  
*E. marlothiana* N.E. Br. 75  
*E. mauritanica* L. 55, 57, 59, 61, 62, 63, 64, 66, 70, 71, 74, 75, 86, 97  
*E. multiceps* Berg. 64  
*E. mundii* N.E. Br. 61, 70, 71, 74  
*E. pentagona* Haw. 55, 57  
*E. pseudocactus* Berg. 53, 55  
*E. pulvinata* Marl. 3  
*E. rectirama* N.E. Br. 55, 57, 59, 61, 68, 86, 98  
*E. schoenlandii* Pax 70  
*E. spinnea* N.E. Br. 72  
*E. stellaeispina* Haw. 60  
*E. stolonifera* Marloth 61, 64, 68  
*E. striata* Thunb. 23, 94  
*E. tetragona* Haw. 54, 55, 56  
*E. tirucalli* L. 23, 28, 29, 46, 52  
*E. triangularis* Desf. 16, 23, 51, 53, 54, 56  
*E. vandermerwei* R.A. Dyer 16  
*Euryops* 3, 4, 105, 106, 107  
*E. annua* Compton 71  
*E. anthemoides* B. Nord. 69, 71, 104  
*E. asparagooides* (Licht. ex Less.) DC. 43  
*E. brachypodus* (DC.) B. Nord. 25  
*E. candollei* Harv. 97  
*E. empetrifolius* DC. 90  
*E. floribundus* N.E. Br. 97  
*E. imbricatus* (Thunb.) DC. 62  
*E. lateriflorus* (L.f.) DC. 62, 81  
*E. laxus* (Harv.) Burtt Davy 102  
*E. multifidus* (Thunb.) DC. 42, 68, 72  
*E. oligoglossus* DC. 81, 98  
*E. oligoglossus* DC. subsp. *racemosus* 97  
*(DC.) B. Nord.*  
*E. tenuissimus* (L.) DC. 62, 74, 97  
*E. transvaalensis* Klatt subsp. *setilobus* (N.E. Br.) B. Nord. 95, 102  
*Eustachys mutica* (L.) Cufod. 24, 29, 30, 39, 41, 42, 43, 51, 63, 72, 87, 90, 92, 98, 99, 104  
*Evolvulus alsinoides* (L.) L. 32  
*Excoecaria simii* (Kuntze) Pax 14  
*Exomis microphylla* (Thunb.) Aell. 18, 51  
*var. microphylla* (=*E. axyriodes* Fenzl)  
*Fadogia* sp. 20  
*F. sp., A. 13300* 14, 17, 18, 53, 84  
*Fagara capensis* Thunb. 19, 22, 26, 82, 85  
*F. davyi* Verdoorn 73  
*Fagonia minutistipula* Engl. 81  
*Falkia oblonga* Bernh. ex Krauss 21  
*Faurea macnaughtonii* Phill. 27, 49, 50  
*F. saligna* Harv. 27, 100  
*F. speciosa* Welw. 71  
*Felicia bergerana* (Spreng.) O. Hoffm. 17  
*F. erigeroides* DC. 51, 60, 63, 65, 69, 81, 88, 97, 98  
*F. filifolia* (Vent.) Burtt Davy, B. 68  
*F. hyssopifolia* (Berg.) Nees 29, 102  
*F. macrorhiza* (Thunb.) DC. 4, 37, 43, 57, 61, 63, 64, 69, 71, 72, 73, 78, 79, 81, 88, 89, 90, 91, 104  
*F. mossamedensis* (Hiern) Mendonca 63, 64  
*F. nuricata* (Thunb.) Nees, G. 97  
*F. ovata* (Thunb.) Compton, G. 8, 83, 95, 96, 98  
*F. petiolata* (Harv.) N.E. Br. 95  
*Festuca* 20, 27, 85, 95, 98, 101  
*F. caprina* Nees. B. 85  
*F. costata* Nees, B. 86, 87, 95, 97, 98  
*F. longipes* Stapf 20, 24, 27, 83, 85, 100, 105, 107  
*F. scabra* Vahl 17  
*Ficinia* 19, 27, 32, 42, 49, 72, 74  
*F. lateralis* Nees (=*F. aphylla* Nees) 13, 16, 19, 22, 23, 24, 27, 49, 50, 85  
*F. sp., A. 15900* 27, 32, 100  
*F. sp., A. 15994* 50  
*F. sp., A. 16157* 30, 49  
*Ficus burtt-dayi* Hutch. 16, 18, 19, 103  
*F. capensis* Thunb. 13, 16, 19, 23, 26, 100  
*F. cordata* Thunb. 73  
*F. craterostoma* Warb. 85  
*F. guerichiana* Engl. 74  
*F. ingens* (Miq.) Miq. 19, 27, 32, 42, 49, 72, 74  
*F. natalensis* Hochst. 13, 16, 19, 22, 23, 24, 27, 49, 50, 85  
*F. petersii* Warb. 23, 28, 100  
*F. pretoriae* Burtt Davy 14, 17, 19, 22, 23  
*F. soldanella* Warb. 23, 28, 100  
*F. sonderi* Miq. 14  
*F. spp.* 15, 24, 28  
*F. stuhlmannii* Warb. 23, 24, 27, 29  
*Fimbristylis complanata* Link. 103  
*F. exilis* Roem. & Schult. 39  
*F. monostachya* Hassk. 95, 103  
*Fingerhuthia africana* Lehmann 31, 32, 37, 42, 43, 60, 63, 64, 68, 69, 72, 73, 74, 81  
*F. sesleriiformis* Nees, GG. 64, 97, 98  
*Flagellaria guineensis* Schumach. 14, 17, 19, 22, 23  
*Flemingia grahamiana* Wight & Arn. 27  
*Fockea* sp. 57  
*F. sp., A. 13661* 72  
*Forskohlea candida* L.f. 63  
*Freylinia lanceolata* (L.f.) G. Don 63  
*Galenia* 69  
*G. africana* L. var. *africana*, B. 61, 62, 64, 66, 68, 70, 71, 74, 76, 81, 82  
*G. fruticosa* Sond. var. *prostrata* 60, 61, 64, 65, 70, 71, 74  
*Adamson* 60, 67, 76  
*G. sarcophylla* Fenzl 60, 67, 76  
*G. sp., A. 13224* 71  
*Galium rotundifolium* L. 82  
*Galopina circaeoides* Thunb. 22, 26, 82, 84, 85  
*Garcinia gerrardii* Harv. ex Sim 22  
*G. livingstonei* T. Anders. 23, 28  
*Gardenia amoena* Sims 14, 84  
*G. spatulifolia* Stapf & Hutch. 50

- Garuleum bipinnatum* (Thunb.) Less., 60, 61  
*G.*  
*G. scelinzii* O. Hoffm., G ..... 72, 73  
*Gasteria* spp. ..... 57  
*Gazania* ..... 68, 89, 95  
*G. lichtensteinii* Less. ..... 60, 68  
*G. krebsiana* Less. subsp. *arctotoides* (Less.) Roessl.  
*G. krebsiana* Less. subsp. *krebsiana* ..... 40  
*G. rigens* R. Br. (L.) Gaertn. ..... 69  
*G. rigens* (L.) Gaertn. var. *uniflora* (L.f.) Roessl.  
*Geigeria* ..... 93  
*G. aspera* Harv., P ..... 89, 92  
*G. brevifolia* (DC.) Harv. ..... 40, 43  
*G. burkei* Harv. ..... 99  
*G. obtusifolia* L. Bol. ..... 40, 43  
*G. ornativa* O. Hoffm., P ..... 40, 41, 42, 43, 63, 64, 67, 72, 73, 81  
*G. pectidea* (DC.) Harv., P ..... 73  
*G. vigintisquamea* O. Hoffm. ..... 73  
*Geissosyriza* ..... 105  
*Geranium ornithopodium* Eckl. & Zeyh.  
*Gerbera aurantiaca* Sch. Bip. ..... 102  
*G. spp.* ..... 102  
*Gethyllis* ..... 105  
*Gibbaeum perviride* (Haw.) N.E. Br. ..... 62  
*G. pubescens* N.E. Br. ..... 62  
*G. shandii* (N.E. Br.) N.E. Br. ..... 62  
*Gladiolus* ..... 105  
*G. ecklonii* Lehm. ..... 23  
*Gloriosa superba* L. ..... 17  
*Glothiphyllum fragrans* (Salm-Dyck) Schwart.  
*G. semicylindricum* (Haw.) N.E. Br. ..... 71  
*Glycine javanica* L., G ..... 17, 19, 32  
*Gnaphalium glomerulatum* Sond. ..... 67  
*Gnidia* ..... 105  
*G. kraussiana* Meisn. ..... 20, 94  
*G. microcephala* Meisn. ..... 102  
*G. myrtifolia* C.H. Wr. ..... 20, 25  
*G. nitida* H. Bol. ..... 81  
*G. nodiflora* Meisn. ..... 25  
*G. polycypala* (C.A. Mey.) Gilg, B ..... 40, 42, 43, 63, 64, 81  
*G. polystachya* Berg. ..... 86  
*Gossypium herbaceum* L. var. *africanum* (Watt) Hutch. & Ghose  
*Grewia* ..... 34, 38, 44, 45, 48, 49, 50  
*G. bicolor* Juss. ..... 32, 45  
*G. flava* DC., G ..... 31, 32, 33, 34, 35, 36, 37, 39, 40, 41, 42, 44, 45, 47, 48, 72, 73, 90  
*G. flavescens* Juss. ..... 30  
*G. hexamita* Burret ..... 28  
*G. lasiocarpa* E. Mey. ex Harv. ..... 14, 19, 84  
*G. monticola* Sond., G ..... 47, 48, 50  
*G. occidentalis* L., G ..... 14, 16, 18, 19, 24, 26, 32, 50, 51, 52, 53, 55, 57, 63, 82, 84, 85, 86, 90, 95, 103  
*G. robusta* Burch., G ..... 54, 55, 57, 58, 60  
*G. tenax* (Forsk.) Fiori ..... 28  
*Grevia sutherlandii* Hook. & Harv. ..... 82, 100, 103  
*Grielium tenuifolium* L. ..... 76  
*Grubbia* ..... 105  
*Grumilea kirkii* Hiern ..... 26  
*Gynandriris simulans* Bak., P ..... 91  
*Haemanthus amarylloides* Jacq. ..... 102  
*Halleria lucida* L. ..... 19, 21, 26, 50, 82, 84, 85, 95, 99, 100, 103  
*Haplocarpha scaposa* Harv. ..... 83, 92, 94  
*Harpagophytum procumbens* (Burch.) DC.  
*Harpochloa falx* (L.f.) Kuntze ..... 23, 83, 84, 88, 94, 95, 97, 100, 101, 103  
*Harpephyllum caffrum* Bernh. ..... 13, 16, 18, 21, 53, 54  
*Haworthia deltoidea* (Hook. f.) Parr ..... 61  
*H. foliosa* Haw. ..... 61  
*H. rubriflora* (L. Bol.) Parr ..... 61  
*Hebenstreitia integrifolia* L. ..... 71  
*H. parviflora* E. Mey. ..... 71  
*Heeria* ..... 24, 30  
*Helichrysum* ..... 17, 67, 96, 105  
*H. acutatum* DC. ..... 99  
*H. adscendens* (Thunb.) Less. ..... 20  
*H. agrostophyllum* Klatt ..... 85, 99  
*H. appendiculatum* (L.f.) Less. ..... 20  
*H. argyrophyllum* DC., B ..... 85  
*H. aureo-nitens* Sch. Bip. ..... 83  
*H. benguellense* Hiern ..... 73  
*H. caespititum* Sond. ..... 39, 99, 103  
*H. callicum* Harv. ..... 90  
*H. coriaceum* Sond. ..... 100  
*H. dregeanum* Sond. & Harv. ..... 88, 89, 91, 104  
*H. hamulosum* E. Mey., B ..... 64, 81, 98  
*H. kraussii* Sch. Bip., B ..... 8, 16, 28, 50, 99  
*H. latifolium* (Thunb.) Less. ..... 83, 94  
*H. leptocephalum* H. Bol. ..... 70  
*H. lucilioides* Less., G ..... 60, 63, 68, 69, 72  
*H. miconiae* DC. ..... 24  
*H. niveum* (L.) Less., B ..... 98  
*H. nudifolium* (L.) Less. ..... 95  
*H. nudifolium* (L.) Less. var. *quinquenervia* (Thunb.) Moeser ..... 22  
*H. odoratissimum* (L.) Less., B ..... 24  
*H. oreophilum* Klatt, B ..... 27, 95, 101  
*H. paronychioides* DC. ..... 39  
*H. pentzioides* Less. ..... 63  
*H. rugulosum* Less. ..... 83, 86, 88, 92, 94, 95, 103, 104  
*H. sp.*, A. 13640  
*H. sinuillum* DC., B ..... 83, 101, 102, 103  
*H. sp.*, cf. *H. anomalam* Less. ..... 86  
*H. sp.*, cf. *H. rosam* (Berg.) Less., A. 29, 57, 9853, B  
*H. sp.*, A. 13735 ..... 55  
*H. splendidum* (Thunb.) Less. ..... 97  
*H. tricostatum* (Thunb.) Less. ..... 76  
*H. trilineatum* DC., B ..... 98  
*H. vestitum* (L.) Less. ..... 106  
*H. zeyheri* Less., G ..... 39, 61  
*Helictotrichon* ..... 85  
*H. capense* Schweick. ..... 86  
*H. hirtulum* (Steud.) Schweick. ..... 24, 95, 97, 98  
*H. turgidulum* (Stapf) Schweick. ..... 98  
*Helinus integrifolius* (Lam.) Kuntze ..... 14, 19, 26, 32, 53, 90  
*Helophilophila rigidissima* Sond. ..... 20  
*H. trifurcata* Burch. ..... 67  
*Heliotropium ciliatum* Kaplan ..... 40  
*Heliotropium staudneri* Vatke ..... 81  
*Helipterum* ..... 105  
*Hereroa bergeriana* Schwart. ..... 73  
*H. funibrata* L. Bol. ..... 71, 80  
*H. latipetala* L. Bol. ..... 62, 71  
*H. odorata* (L. Bol.) L. Bol. ..... 62, 71  
*H. stanleyi* (L. Bol.) L. Bol. ..... 62, 71  
*Hermannia* ..... 3  
*H. abrotanoides* Schrad. ..... 72, 73  
*H. betonicifolia* Eckl. & Zeyh. ..... 88, 95  
*H. coccocarpa* Kuntze ..... 89  
*H. comosa* DC. ..... 40  
*H. cuneifolia* Jacq., G ..... 60, 69  
*H. depressa* N.E. Br. ..... 88, 94, 103  
*H. flammea* Jacq. ..... 86  
*H. gracilis* Eckl. & Zeyh. ..... 55  
*H. grandiflora* Ait., G ..... 60, 69  
*H. helianthemum* K. Schum. ..... 72  
*H. incana* Cav. ..... 51, 57, 76, 104  
*H. linifolia* Burm. f., G ..... 60, 61, 76  
*H. multiflora* Jacq. ..... 63, 70  
*H. paucifolia* Turcz. ..... 67, 68  
*H. saccifera* (Turcz.) K. Schum. ..... 86  
*H. spinosa* E. Mey. ex Harv. ..... 60, 66, 67, 68, 69, 73, 77  
*H. stricta* (E. Mey. ex Turcz.) Harv. ..... 75  
*H. tomentosa* (Turcz.) Schinz ex Engl. ..... 39  
*H. trifurca* L. ..... 64, 76  
*H. vestita* Thunb. ..... 72  
*Hermbstaedtia glauca* (Wendl.) 74 Reichb. ex Steud.  
*Herniaria erckertii* Hermann subsp. *erckertii* var. *dewetii* Herman ..... 89  
*Hervea nelii* Schwart. ..... 80  
*Heteromorpha arborescens* (Spreng.) Cham. & Schlechtld. ..... 26, 82, 84, 90, 101  
*Heteropogon* ..... 60, 100  
*H. contortus* (L.) Beauv. ex Roem. & Schult. ..... 14, 16, 20, 23, 24, 28, 29, 30, 31, 32, 34, 38, 39, 41, 42, 43, 44, 47, 48, 49, 50, 51, 53, 54, 58, 59, 60, 63, 83, 84, 86, 87, 88, 90, 92, 94, 95, 96, 98, 99, 100, 101, 103, 104  
*Heteroptilis suffruticosa* (Berg.) Leute ..... 17  
*Heteropyxis natalensis* Harv. ..... 23, 53  
*Hewittia sublobata* (L.f.) Kuntze ..... 15  
*Heywoodia lucens* Sim ..... 13  
*Hibiscus atromarginatus* Eckl. & Zeyh. ..... 89, 104  
*H. calyphyllus* Cav. ..... 30, 53  
*H. marlothianus* Schum. ..... 40

<i>H. microcarpus</i> Garcke .....	39	<i>J. capensis</i> Thunb. ....	57
<i>H. pendunculatus</i> Cav. ....	14	<i>J. flava</i> Vahl ....	16, 30, 37
<i>H. tiliaceum</i> L. ....	17	<i>J. orchioidea</i> L.f. ....	69, 76, 81
<i>Hippobromus pauciflorus</i> (L.f.) Radlk. ....	16, 18, 19, 51, 53, 84, 103	<i>J. thymifolia</i> C.B.Cl. ....	72
<i>Hippocratea</i> sp. ....	15, 19	<i>Kalanchoe</i> ....	37, 55
<i>Hippicium alienatum</i> (L.f.) Druce, G. ....	61, 64, 65, 69, 70	<i>K. pyramidalis</i> Schonl. ....	42
<i>H. integrifolium</i> (Thunb.) Less., G. ....	61	<i>K. rotundifolia</i> Haw. ....	17, 29, 37, 53, 55
<i>Hoffmannseggia sandersonii</i> (Harv.) Benth. & Hook. ....	103	<i>Karoochloa curva</i> (Nees) Conert & Türpe	4, 24, 85, 98
<i>Homeria</i> ....	105	<i>K. purpurea</i> (L.f.) Conert & Türpe .	95, 97, 98
<i>H. pura</i> N.E. Br., P. ....	63, 91	<i>Kedrostis</i> ....	57
<i>H. speciosa</i> L. Bol. ....	71	<i>Kiggelaria africana</i> L. ....	13, 21, 26, 28, 63, 82, 84, 85, 95, 99
<i>Hoodia gordoni</i> Sweet ....	71, 73	<i>Kirkia acuminata</i> Oliv. ....	44
<i>Hoplophyllum spinosum</i> DC. ....	70	<i>K. wilmsii</i> Engl. ....	28, 32, 46, 47, 49
<i>Hoslundiella opposita</i> Vahl ....	29	<i>Kissenia capensis</i> Endl. ....	72
<i>Huernia</i> ....	70	<i>Kochia pubescens</i> Moq. ....	63, 70, 71
<i>Hybanthus enneaspernus</i> (L.) F. von Muell. ....	20	<i>Koeleria cristata</i> (L.) Pers. ....	86, 95, 97, 98
<i>H. cymbalaria</i> (L.) Stapf ....	26	<i>Kohautia amatynica</i> Eckl. & Zeyh.	23, 83, 94, 99
<i>H. filipendula</i> (Hochst.) Stapf ....	14	<i>Kraussia floribunda</i> Harv. ....	15
<i>H. hirta</i> (L.) Stapf ....	8, 23, 24, 27, 29, 31, 42, 62, 83, 86, 87, 90, 99, 100, 101, 102, 103, 104	<i>Kyllinga</i> ....	88, 89
<i>H. poecilotricha</i> (Hack.) Stapf ....	24	<i>K. alba</i> Nees ....	37, 39
<i>H. sp., cf. H. tamba</i> (Hochst. ex Steud.) Anderss. ex Stapf	27	<i>Lachenalia</i> ....	105
<i>Hypericum aethiopicum</i> Thunb. ....	23	<i>Lampranthus godmaniae</i> L. Bol. ....	65
subsp. <i>sonderi</i> (Bred.) Robson		<i>L. laworthii</i> (Don) N.E.Br. ....	62
<i>H. revolutum</i> Vahl ....	26, 27	<i>L. henricii</i> (L.Bol.) N.E.Br. ....	62
<i>Hypertelis salsolooides</i> (Burch.) Adamsom	60	<i>L. lunatus</i> (Willd.) N.E.Br. ....	70
<i>Hyperthelia dissoluta</i> (Nees ex Steud.) Clayton	24, 27, 28, 50	<i>L. uniflorus</i> L. Bol. var. <i>spathulatus</i> (L.Bol.) L.Bol. ex Jacobs	62, 65, 70, 71
<i>H. poecilotricha</i> (Hack.) Stapf ...	27	<i>L. watermeyeri</i> (L. Bol.) N.E.Br. ....	65, 70
<i>H. sp. cf. H. tamba</i> (Hochst. ex Steud.) Anderss. ex Stapf	27	<i>Landolphia kirkii</i> T.-Dyer ....	15
<i>H. tamba</i> (Hochst. ex Steud.) Anderss. ex Stapf	102	<i>Lannea discolor</i> (Sond.) Engl. ....	27, 29, 32, 44, 49
<i>Ibyza riparia</i> (Hochst.) N.E.Br. ....	23	<i>L. edulis</i> (Sond.) Engl. ....	28
<i>Ifloga paronychioides</i> (DC.) Fenzl ..	67, 82	<i>Lantana rugosa</i> Thunb. ....	53, 72
<i>Ilex mitis</i> (L.) Radlk. ....	19, 26, 50, 84	<i>Lapeirousia</i> ....	105
<i>Impatiens duthieae</i> L. Bol. ....	26, 82, 85	<i>Laportea peduncularis</i> (Wedd.) Chew	22, 26, 84
<i>Imperata</i> ....	103	<i>Lasiochloa</i> ....	105
<i>I. cylindrica</i> (L.) Beauv. ....	16, 17	<i>L. longifolia</i> (Schrad.) Kunth ....	70, 81, 85, 86, 87
<i>Indigofera</i> ....	17	<i>Lasicorys capensis</i> Benth. ....	43, 55, 57, 72, 73
<i>I. alternans</i> DC. ....	89, 92	<i>Lasiostiphon anthylloides</i> Meisn. ....	17, 101
<i>I. argyrea</i> Eckl. & Zeyh. ....	67	<i>L. macroperatus</i> Meisn. ....	17
<i>I. daeleoides</i> Benth. ....	34, 39	<i>L. meierianus</i> Endl. ....	55, 59, 60
<i>I. eriocarpa</i> E. Mey. ....	15	<i>L. nanus</i> Burtt Davy ....	102
<i>I. fastigiata</i> E. Mey. ....	99	<i>L. spp.</i> ....	15
<i>I. hedyantha</i> Eckl. & Zeyh. ....	24, 102	<i>Lebeckia cytisoides</i> Thunb. ....	62
<i>I. heterotricha</i> DC. ....	72	<i>L. macrantha</i> Harv. ....	41, 42
<i>I. hilaris</i> Eckl. & Zeyh. ....	20, 23, 24, 83, 99, 102	<i>L. multiflora</i> E. Mey. ....	70
<i>I. micrantha</i> E. Mey. ....	14	<i>L. sericea</i> Thunb. ....	74
<i>I. natalensis</i> Bol. ....	19	<i>L. spinescens</i> Harv. ....	60, 64, 68, 69, 76
<i>I. oxytropis</i> Benth. ....	99, 102	<i>Leersia hexandra</i> Swartz ....	19
<i>I. poliotae</i> Eckl. & Zeyh. ....	24	<i>Leipooldia</i> ....	62
<i>I. pungens</i> E. Mey. ....	74	<i>L. constricta</i> (L. Bol.) L. Bol. ....	65
<i>I. rostrata</i> Bol. ....	20, 23, 94	<i>L. nelii</i> L. Bol. ....	70
<i>I. sessilifolia</i> DC. ....	51, 58, 72	<i>Leontotis intermedia</i> Lindl. ....	103
<i>I. spinescens</i> E. Mey. ....	97	<i>L. leonurus</i> (L.) Bol. ....	15, 22, 85
<i>I. stenophylla</i> Eckl. & Zeyh. ....	59	<i>Lepidium desertorum</i> Eckl. & Zeyh.	67
<i>I. velutina</i> E. Mey. ....	99	<i>Lessertia pauciflora</i> Harv. var. <i>schlechteri</i> L. Bol.	63
<i>Ipomoea albivenia</i> (Lindl.) Sweet ..	29	<i>Leucadendron</i> ....	105
<i>I. carica</i> (L.) Sweet ....	17	<i>L. eucalyptifolium</i> E. Mey. ex Meisn.	20
<i>I. crassipes</i> Hook. ....	29, 94, 95	<i>Leucosphaera baiesii</i> (Hook.f.) Gilg	75
<i>I. pes-caprae</i> (L.) R.Br. ....	17	<i>Leysnera tenella</i> DC. ....	68
<i>Ischaemum afrom</i> (J.F.Gmel.) Dandy	31, 32	<i>Lightfootia</i> ....	3, 105
<i>I. arcuatum</i> (Nees) Stapf ....	19	<i>L. albens</i> Spreng. ex A. DC. ....	81
<i>Isoglossa</i> ....	14	<i>L. tenella</i> Lodd. ....	63
<i>Ixia</i> ....	105	<i>L. thunbergiana</i> Buek ....	64
<i>Jasminum angulare</i> Vahl ....	18, 53, 103	<i>Limeum aethiopicum</i> Burm. subsp. <i>aethiopicum</i> , G	43, 55, 60, 63, 66, 68, 69, 72, 73
<i>J. multipartitum</i> Hochst. ....	52	<i>L. argute-carinatum</i> Wawra & Peyr. ....	67
<i>J. stenolobum</i> Rolfe ....	53, 85	var. <i>kwebense</i> (N.E.Br.) Friedr.	
<i>Jatropha capensis</i> Sond. ....	54, 55	<i>Limonium perigrinum</i> (Berg.) R.A. ....	75
<i>Justicia</i> ....	32	Dyer	
<i>J. anagalloides</i> T. Anders. ....	99	<i>Linociera foveolata</i> (E. Mey.) Knobl.	13, 16, 18, 75, 84, 87
<i>J. campylostemon</i> T. Anders. ....	14	<i>Linum thunbergii</i> Eckl. & Zeyh. ....	24
		<i>Lippia javanica</i> (Burmf.) Spring, B	15, 27, 29
		<i>L. scaberrima</i> Sond., B ....	90
		<i>Lobelia</i> ....	105
		<i>L. coronopifolia</i> L. ....	20
		<i>L. erinus</i> L. var. <i>bellidifolia</i> Sond. ....	24
		<i>L. patula</i> L.f. ....	19
		<i>L. scabra</i> Thunb. ....	17
		<i>Lobostemon</i> ....	105
		<i>L. argenteus</i> (Berg.) Buek ....	4
		<i>Lonchocarpus capassa</i> (Klotzsch) Rolfe	27, 28

- Lophiocarpus polystachyus* Turcz. .... 73  
*Lopholaena platyphylla* Benth. .... 101  
*Lotononis calycina* (E. Mey.) Benth. .... 95  
*L. leptoloba* H. Bol. .... 71  
*L. platycarpa* (Viv.) Pichi Serm. .... 67  
*Loudetia* .... 100, 103  
*L. simplex* (Nees) C.E. Hubb., B. .... 14, 20, 27, 28, 34, 44, 45,  
   46, 48, 49, 50, 86, 95,  
   96, 99, 100, 101, 103  
*Loxostylis* .... 20  
*L. alata* Spreng. ex Reichb. .... 19  
*Lycium* .... 38, 42, 55, 56, 58, 63, 64,  
   69, 70, 73, 74, 75  
*L. afrum* L. .... 57, 76  
*L. arenicolum* Miers .... 60, 61, 63, 67, 69, 71  
*L. austrinum* Miers .... 58, 60, 61, 67, 72  
*L. campanulatum* E. Mey. .... 57  
*L. hirsutum* Dun. .... 40  
*L. oxycladum* Miers .... 64, 66, 68, 71, 79, 81  
*L. prunus-spinosa* Dun. .... 63, 67, 69  
*Macaranga* .... 20, 21  
*M. capensis* (Baill.) Benth. .... 13, 14, 16, 19, 20, 23  
*Machaerophyllum acuminatum* L. Bol. .... 59  
*Mackaya bella* Harv. .... 22  
*Macowania revoluta* Oliv. .... 84  
*Macrostachys* .... 105  
*Maerua gilgii* Schinz .... 75  
*M. juncea* Pax subsp. *crustata* (Wild.) Wild. .... 20  
*M. parvifolia* Pax .... 18, 24, 57  
*M. rosmarinoides* (Sond.) Gilg & Ben. .... 53  
*Maesa alnifolia* Harv. .... 14, 22, 84  
*M. lanceolata* Forsk. .... 22, 23, 26, 27, 85, 101, 102  
*Maledorphia framesii* (L. Bol.) Jacobs. & Schwart. .... 65, 70  
*M. luteola* (Haw.) Schwart., B. .... 71  
*M. spp.* .... 65  
*M. uitteagensis* (L. Bol.) Jacobs. & Schwart., B. .... 56, 69, 71  
*Manilkara concolor* (Harv.) ex C.H.Wr. Gerstn. .... 28, 30  
*Manochlamys albicans* (Ait.) ex Soland. Aellen .... 70, 76  
*Manulea fragrans* Schltr. .... 67  
*M. laxa* Schltr. .... 76  
*Marattia fraxinea* Sm. .... 23  
*Mariscus capensis* Schrad. .... 104  
*M. congestus* C.B.Cl. .... 17  
*M. dregeanus* Kunth .... 17, 104  
*M. sieberiana* Nees .... 17  
*M. sp., A. 12460* .... 37  
*Maurandya frangularia* (L.) Mill. .... 75  
*Maytenus* .... 32  
*M. acuminata* (L.f.) Loes. .... 22  
*M. acuminata* (L.f.) Loes. var. *acuminata* .... 82, 84, 85  
*M. capitata* (E. Mey. ex Sond.) Marais .... 51, 55, 57, 58, 86  
*M. heterophylla* (Eckl. & Zeyh.) N. Robson .... 3, 18, 30, 31, 37, 41, 42,  
   48, 52, 53, 56, 60, 69,  
   75, 82, 84, 86, 87, 95,  
   103  
*M. linearis* (L.f.) Marais .... 75  
*M. mossambicensis* (Klotzsch) Blakelock .... 14, 26, 82, 84  
*M. mossambicensis* (Klotzsch) Blakelock var. *rubra* (Harv.) Blakelock .... 22, 82, 85  
*M. pedicularis* (Sond.) Loes. .... 19, 24, 84, 103  
*M. polycantha* (Sond.) Marais .... 51, 53, 56, 57, 58, 60  
*M. senegalensis* (Lam.) Exell .... 15, 23, 24, 27, 28, 47, 48,  
   49, 104  
*M. tenuispina* (Sond.) Marais .... 34, 49  
*M. undata* (Thunb.) Blakelock .... 18, 30, 42, 54, 55, 59, 63  
*Medicago aschersoniana* Urb. .... 67  
*Melhania* .... 32  
*M. rehmannii* Szyszyl. .... 73  
*Melianthus comosus* Vahl .... 42  
*M. major* L. .... 86  
*Melica decumbens* Thunb. .... 98  
*M. racemosa* Thunb. .... 59  
*Melinis macrochaeta* Stapf & C.E. Hubb. .... 26  
*Melolobium* .... 98  
*M. sp., A 15989* .... 97  
*Merciera* .... 105  
*Merxmullera* .... 4, 8, 85, 59, 63, 81, 98,  
   105, 109  
*M. disticha* (Nees) Conert, B. .... 4, 24, 56, 59, 63, 81, 86,  
   95, 97, 98  
*M. macowanii* (Stapf) Conert .... 86, 95  
*M. rufa* (Nees) Conert .... 86  
*M. stricta* (Schrad.) Conert, B. .... 4, 59, 64, 74, 81, 86, 87, 98  
*Mesembryanthemum* .... 76, 86  
*M. annuum* L. Bol. .... 60, 61, 65, 68, 71  
*M. chrysanthemum* L. Bol. .... 65, 68, 70  
*M. karrroeense* L. Bol. .... 71  
*M. sedentiflorum* (L. Bol.) L. Bol. .... 70  
*M. stephanum* (L. Bol.) L. Bol. .... 70  
*Mestoklema tuberosum* (L.) N.E.Br. .... 55, 58  
*Metalasia* .... 105, 107  
*M. muricata* (L.) Less. .... 17, 25, 84, 97, 98, 101  
*Micranthus* .... 105  
*Microclodia* .... 104  
*M. caffra* Nees .... 23, 27, 50, 83, 84, 86, 87,  
   88, 89, 92, 94, 95, 100,  
   101, 103, 104  
*Microdon cylindricus* E. Mey. .... 61  
*Microlobia incanum* Decne. .... 73, 74  
*M. massonii* Schltr. .... 60, 63  
*(Microstrophium)* see *Arctotheca*  
*Mikania capensis* DC. .... 26  
*Milletia grandis* (E. Mey.) Skeels .... 13, 14, 16, 19, 20  
*M. sutherlandii* Harv. .... 13, 19  
*Minusops caffra* E. Mey. .... 16, 17  
*M. obovata* Sond. .... 19  
*M. zeyheri* Sond. .... 50  
*Misanthidium capense* (Nees) Stapf, G. .... 14, 22, 23  
*M. sorghum* (Nees) Stapf, G. .... 42  
*Mohria caffrorum* L. Desv. .... 22  
*Mollugo cerviana* (L.) Ser. .... 60  
*Monechma atherstonei* C.B.Cl. .... 60  
*M. desertorum* (Engl.) C.B.Cl. .... 67, 73, 77  
*M. fimbriatum* C.B.Cl. .... 75  
*M. incanum* (Nees) C.B.Cl. .... 40, 43, 77  
*M. mollissimum* P.G. Mey. .... 75  
*M. pseudopatulum* C.B.Cl., G. .... 60, 61, 66, 71  
*M. spartioides* (T. Anders.) C.B.Cl. .... 72  
*Monilaria* sp. .... 70  
*Monocymbium ceresiiforme* (Nees) Stapf .... 20, 23, 27, 83, 86, 94, 95,  
   99, 100, 101, 102, 103  
*Monosousa* .... 105  
*M. ovata* Cav. .... 17, 24  
*Montinia caryophyllacea* Thunb. .... 4, 59, 73, 74  
*Moraea* .... 105  
*M. iridioides* L. .... 14, 22, 26, 54, 82, 84, 85  
*M. polystachya* Ker. .... 60, 63, 91  
*M. sp., A. 12611* .... 66  
*Mosdenia leptostachys* (Fical. & Hiern) Clayton .... 39  
*Mucuna coriacea* Bak. subsp. *irritans* (Burtt Davy) Verdc. .... 29  
*Mundulea sericea* (Willd.) A. Chev. .... 30, 38, 39, 45, 46, 48  
   8, 20, 105  
*M. filiformis* (Thunb.) DC. .... 86  
*M. macowanii* Levyns .... 25  
*M. macroceras* DC. .... 98  
*M. stipulacea* (Burm.f.) DC. .... 20  
*M. thymifolia* (Thunb.) DC. .... 86  
*Myrica brevifolia* E. Mey. ex C. DC. .... 84  
*M. sp.* .... 85  
*M. sp. A. 11561* .... 00  
*Myrsine africana* L. .... 3, 63, 75, 82, 86, 87, 95,  
   97, 100  
*Nenax microphylla* (Sond.) Salter. .... 43, 63, 81, 104  
*Neurautanenia* sp. .... 38  
*Nerine* .... 105  
*Nestleria acerosa* (DC.) Harv. .... 97  
*N. conferta* DC., B. .... 63, 64, 69, 79, 81  
*N. lumenii* Less. .... 42, 43, 61, 63, 64, 66, 68,  
   69, 73, 104  
*N. prostrata* Harv., BB. .... 63, 64, 81, 98  
*Nicotiana glauca* R. Grah. .... 60, 63, 71  
*Nidorella auriculata* DC. .... 15, 22  
*N. hottentotica* DC. .... 99  
*Nolletia ciliaris* (DC.) Steetz .... 39, 40  
*Noltia* .... 20  
*N. africana* (L.) Reichb.f. .... 19, 86  
*Nuxia congesta* R. Br. ex Fresen. .... 26, 27, 49  
*N. floribunda* Benth. .... 19, 20, 26  
*N. gracilis* Engl. .... 42  
*N. oppositifolia* (Hochst.) Benth. .... 15  
*Nylandia* .... 105  
*N. spinosa* (L.) Dumort. .... 76  
*Nymania capensis* (Thunb.) Lindb. .... 4, 42, 58, 59, 61, 72, 75  
*Ochna arborea* Burch. ex DC. .... 18

<i>O. natalitia</i> (Meisn.) Walp.	15	<i>P. maximum</i> Jacq., GG	3, 14, 16, 17, 19, 23, 24,
<i>O. pulchra</i> Hook.	44, 45, 46, 49		26, 29, 32, 33, 34, 35,
<i>Ocimum canum</i> Sims	29		36, 37, 38, 39, 46, 48,
<i>Ocotea bullata</i> (Burch.) E. Mey.	21, 22		49, 50, 53, 54, 55, 57,
<i>Octopoma</i> spp.	74		58, 59, 69, 90
<i>Olas dissitiflora</i> Oliv.	28	<i>P. natalense</i> Hochst.	20, 27, 50, 83, 95, 99,
<i>Olea africana</i> Mill.	4, 18, 24, 28, 30, 32, 41, 42, 46, 50, 51, 53, 56, 63, 72, 73, 86, 87, 90, 95, 97		100, 101, 103
<i>O. capensis</i> L. subsp. <i>macrocarpa</i> (C.H.Wr.) Verdoorn	13, 16, 21, 22, 84	<i>P. staphianum</i> Fourc., G	36, 42, 51, 56, 64, 69, 73, 92, 104
<i>O. exasperata</i> Jacq.	18, 86, 87	<i>Pappea capensis</i> Eckl. & Zeyh., G	23, 30, 32, 48, 49, 53, 55,
<i>O. woodiana</i> Knobl.	18, 22, 26, 27		56, 58, 61, 73, 74, 80
<i>Olinia</i>	82, 85, 101, 103	<i>Paranomus</i>	105
<i>O. cymosa</i> Thunb.	18	<i>Parinari capensis</i> Harv.	99, 100
<i>O. emarginata</i> Burtt Davy	18	<i>P. curatellifolia</i> Planch. ex Benth. subsp. <i>curatellifolia</i>	27
<i>Ophioglossum polypodium</i> A. Braun	66, 67	<i>P. curatellifolia</i> Planch. ex Benth. subsp. <i>mobola</i> (Oliv.) Grah.	15, 16
<i>Ophrestia oblongifolia</i> (E. Mey.) H.M. Forbes	99	<i>Parkinsonia africana</i> Sond.	4, 73
<i>Oplismenus hirtellus</i> (L.) Beauv.	14, 17, 19, 22, 26, 82, 84, 85	<i>Paspalum notatum</i> Fluegge	93
<i>Opuntia ficus-indica</i> (L.) Mill.	57	<i>P. orbiculare</i> Forsk.	14, 17, 20, 23, 27, 103
<i>Oriaria bachmannii</i> (Engl.) Verdoorn	14, 18, 19, 22	<i>Passerina</i>	4, 8, 25, 105, 107
<i>Ormocarpum trichocarpum</i> (Taub.) Harms ex Burtt Davy	28, 48, 49	<i>P. filiformis</i> L., B.	8
<i>Ornithogalum</i>	105	<i>P. montana</i> Thod.	4, 81, 97, 98
<i>Ornithoglossum viride</i> (L.f.) Ait.	41, 60, 73	<i>P. obtusifolia</i> Thod.	59
<i>Oropetium</i>	66	<i>P. rigidula</i> Wikstr., G	4, 17
<i>O. capense</i> Stapf	3, 32, 60, 64, 66, 67, 69, 73, 90	<i>Pavetta</i>	18
<i>Orthosiphon serratus</i> Schltr.	29	<i>P. bowkeri</i> Harv.	19, 22
<i>Osmunda regalis</i> L.	101	<i>P. cooperi</i> Harv. & Sond.	103
<i>Osteospermum armatum</i> Norl., B.	67, 68	<i>P. edentula</i> Sond.	27
<i>O. grandidentatum</i> DC.	22	<i>P. kotzei</i> Brem.	84
<i>O. herbaceum</i> L.f.	22	<i>P. lanceolata</i> Eckl.	17
<i>O. imbricatum</i> L. subsp. <i>nervatum</i> (DC.) Norl.	20, 86	<i>P. zeyheri</i> Sond.	100
<i>O. leptolobum</i> (Harv.) Norl., G	63, 77	<i>Pavonia praenorsa</i> Willd.	18
<i>O. microphyllum</i> DC.	61, 69, 72	<i>Pearsonia cajanifolia</i> (Harv.) Polhill	99
<i>O. muricatum</i> E. Mey.	43	<i>Peddiea africana</i> Harv.	14, 19, 26, 82, 85
<i>O. oppositifolia</i> (Ait.) Norl.	74	<i>Pegolettia retrofracta</i> (Thunb.) P. Kies	43, 63, 69, 72, 73
<i>O. scariosum</i> DC.	63, 89, 92	<i>P. tenuifolia</i> H. Bol.	50
<i>O. sinuatum</i> (DC.) Norl., G	60, 61, 64, 68, 70, 71	<i>Pelargonium</i>	74, 105
<i>O. spinescens</i> Thunb.	63, 69	<i>P. abrotanifolium</i> (L.f.) Jacq.	104
<i>Osyridocarpus schimperianus</i> (Hochst. ex A. Rich.) A. DC.	82	<i>P. aconitophyllum</i> Eckl. & Zeyh.	102
<i>Osyris lanceolata</i> Hochst. & Steud.	49, 63, 86, 101	<i>P. aridum</i> R.A. Dyer	98
<i>Othonna</i>	105, 106	<i>P. cordatum</i> L. 'Hérít.'	84
<i>O. abrotanifolia</i> Harv.	74	<i>P. critmifolium</i> Smith	74
<i>O. arbuscula</i> Sch. Bip.	74	<i>P. dichondraefolium</i> DC.	98
<i>O. auriculaefolia</i> Licht. ex Less.	98	<i>P. fulgidum</i> (L.) Ait.	70, 75
<i>O. floribunda</i> Schltr.	70, 74	<i>P. gibbosum</i> (L.) Ait.	75
<i>O. graveolens</i> O. Hoffm.	74	<i>P. multicaule</i> Jacq.	98
<i>O. pallens</i> DC., B	40, 43	<i>P. peltatum</i> (L.) Ait.	18, 53, 55, 56, 61
<i>O. pavonia</i> E. Mey.	63	<i>P. querctifolium</i> (L.f.) Ait.	98
<i>O. sp.</i> , A. 15094	74	<i>P. ramosissimum</i> Willd.	61, 98
<i>Oxalis beneprotecta</i> Dinter ex Knuth	67	<i>P. sidaefolium</i> (Thunb.) Knuth	104
<i>O. depressa</i> Eckl. & Zeyh.	89	<i>P. sp.</i> , A. 14118, 15142	64
<i>O. semiloba</i> Sond.	57	<i>P. squarrosum</i> Dinter	61, 74
<i>Oxyanthus gerrardii</i> Sond.	22	<i>Peliostomum</i>	00
<i>Oxygonum dregeanum</i> Meisn. var. <i>canescens</i> (Sond.) R. Grah.	29, 99	<i>P. leucorrhizum</i> E. Mey. ex Benth.	40, 43, 66, 68, 77
<i>Ozoroa concolor</i> (Presl ex Sond.)	74	<i>Pellaea viridis</i> (Forsk.) Prantl	14, 22, 23, 26, 54, 82
De Wint.		<i>P. viridis</i> (Forsk.) Prantl var.	14
<i>O. engleri</i> R. & A. Fernandes	28	<i>Peltophlorum africanum</i> Sond.	24, 27, 28, 34, 39, 45, 47, 48, 49
<i>O. mucronata</i> (Bernh.) R. & A.	55	<i>Penaeaceae</i>	105
Fernandes		<i>Pennisetum sphacelatum</i> (Nees) Dur. & Schinz, G	85, 97
<i>O. paniculosa</i> (Sond.) R. & A.	28, 103	<i>Petamenes</i>	105
Fernandes		<i>Pentanisia prunelloides</i> (Klotzsch ex Eckl. & Zeyh.) Walp.	15, 20, 23, 83, 95, 99, 101, 102, 103
<i>O. reticulata</i> (Bak.f.) R. & A.	48	<i>Pentaschistis</i>	59, 70, 74, 86, 98, 105, 107
Fernandes		<i>P. angustifolia</i> (Nees) Stapf	24
<i>Pachygodium namaquanum</i> (Wyley ex Harv.) Welw.	74, 75	<i>P. brachiathera</i> Stapf	74
<i>P. succulentum</i> (L.f.) A. DC.	61, 72	<i>P. eriostoma</i> (Nees) Stapf	87
<i>Pachystigma triflorum</i> Robyns	50	<i>P. micropyllea</i> (Nees) McClean	95, 97
<i>P. vernosum</i> Hochst.	16	<i>P. natalensis</i> Stapf	95
<i>Panicum</i>	3, 34, 36, 51	<i>P. sp.</i> , A. 11960, 11950	98
<i>P. aequinerve</i> Nees	14, 20, 22, 23, 82, 85	<i>P. sp.</i> , A. 14796	70
<i>P. chusquoides</i> Hack.	19	<i>P. sp.</i> , A. 15700	98
<i>P. coloratum</i> L., G	29, 31, 32, 34, 35, 37, 39, 47, 48, 81, 88, 89, 90, 91, 92	<i>Pentzia</i>	3, 8, 105
<i>P. deustum</i> Thunb., G	16, 17, 18, 24, 29, 30, 36, 53, 54, 55, 57	<i>P. annua</i> DC.	67
<i>P. dregeanum</i> Nees	20	<i>P. argentea</i> Hutch., G	72, 73
<i>P. ecklonii</i> Nees	27, 83, 95, 101	<i>P. cooperi</i> Harv., B	8, 89, 97, 98
<i>P. laevifolium</i> Hack., G	36, 92	<i>P. globosa</i> Less., G	42, 43, 60, 63, 65, 73, 78, 79, 81, 82, 88, 89, 91
<i>P. lanipes</i> Mez	67, 73	<i>P. incana</i> (Thunb.) Kuntze (anker- karoo), G	3, 39, 40, 42, 43, 51, 58, 60, 61, 63, 64, 69, 71, 77, 78, 79, 80, 81, 104
<i>P. sp.</i> , cf. <i>P. laticomum</i> Nees	14	<i>P. lanata</i> Hutch.	63, 64, 73
		<i>P. pinnatisecta</i> Hutch., G	67
		<i>P. punctata</i> Harv.	81
		<i>P. sp.</i> A. 14409	64
		<i>P. sp.</i> (tall ankerkaroo)	00
		<i>P. sphaerocephala</i> DC., G	63, 72
		<i>P. spinescens</i> (Thunb.) Less., G	60, 63, 64, 66, 67, 68

<i>P. viridis</i> P. Kies, G	40	<i>P. longifolia</i> (Burm.) Engl.	13, 14, 19, 20, 23, 26, 85
<i>Peperomia tetraphylla</i> (G. Forster) Hook. & Arn.	26, 82, 84	<i>Prunus africana</i> (Hook. f.) Kalkm.	85
<i>Peristrophe natalensis</i> T. Anders.	53	<i>Pseudarthria hookeri</i> Wight & Arn.	15
<i>Perotis patens</i> Gand.	16, 29, 100	<i>Pseudolachnostylis maprouneifolia</i> Pax	50
<i>Petalidium</i>	32	<i>Psiadia punctulata</i> (DC.) Oliv. & Hiern ex Vatke	35
<i>Phaeoptilum spinosum</i> Radlk.	4, 67, 68, 72, 73, 75, 77, 79	<i>Psidium guajava</i> L.	17, 27
<i>Pharnaceum</i>	105	<i>Psilocaulon absinile</i> N.E.Br.	43, 58, 60, 61, 68, 79, 80
<i>Phaulopsis</i>	14	<i>P. sp.</i>	67, 68, 71
<i>Philippia</i>	4, 98, 105	<i>P. acutisepalum</i> (Berger) N.E.Br.	70
<i>P. evansii</i> N.E.Br.	20	<i>P. arenosum</i> (Schinz) Bol.	80
<i>Phoenix reclinata</i> Jacq.	15, 16, 23, 24, 27, 29	<i>P. corallinum</i> (Thunb.) Schwant.	70
<i>Phragmites australis</i> (Cav.) Trin. ex Steud., G	63, 64	<i>P. foliosum</i> L. Bol.	70
<i>Phylitica</i>	105, 107	<i>P. rapaceum</i> (Jacq.) Schwant.	70
<i>P. paniculata</i> Willd.	20, 97	<i>P. sinile</i> (Sond.) Schwant.	61
<i>P. sinuifolia</i> Pillans	84	<i>P. utile</i> L. Bol.	61, 65, 70, 71
<i>Phyllanthus glaucophyllus</i> Sond.	102	<i>Psoralea obtusifolia</i> DC.	69
<i>P. maderaspatensis</i> L.	72	<i>P. polysticta</i> Benth.	101
<i>P. reticulatus</i> Poir.	28	<i>Psychotria capensis</i> (Eckl.) Vatke	14, 17, 18, 19, 24, 26
<i>P. verrucosus</i> Thunb.	53, 55, 57	<i>Ptaeroxylon</i>	16
<i>Phyniaspermum</i>	3	<i>P. obliquum</i> (Thunb.) Radlk.	3, 13, 16, 18, 26, 30, 46, 51, 53, 54, 55, 57, 82, 84, 85
<i>P. aciculare</i> (E. Mey. ex DC.) Benth. & Hook. f. ex Jackson, G	63	<i>Pteridium aquilinum</i> (L.) Kuhn	22, 23, 26, 82, 85, 86
<i>P. pubescens</i> Kunze	58, 69	<i>Pteris catoptera</i> Kunze	22, 26, 85
<i>P. sp., A</i> 14642	81	<i>Pterocarpus</i>	44
<i>Piliostigma thomningii</i> (K. Schum.) Milne-Redh.	27	<i>P. angolensis</i> DC.	27
<i>Piper capense</i> L.f.	26	<i>P. rotundifolius</i> (Sond.) Druce subsp. <i>rotundifolius</i>	27, 29, 30, 45, 48
<i>Pittosporum viridiflorum</i> Sim	16, 18, 19, 21, 26, 50, 63, 82, 84, 85, 100	<i>Pterocelastrus echinatus</i> N.E.Br.	26, 27, 101
<i>Plagiochloa</i>	86, 105	<i>P. tricuspidatus</i> Sond.	16, 18, 75, 84, 87, 101
<i>Platycarpha parvifolia</i> S. Moore	92	<i>Pterodiscus speciosus</i> Hook.	37
<i>Plectranthus</i>	26	<i>Pterolobium exosum</i> (J.F.Gmel.) Bak.f.	28
<i>P. ciliatus</i> E. Mey.	19, 22	<i>Pteronia</i>	3, 68, 86, 105
<i>P. ecklonii</i> Benth.	14, 22, 84	<i>P. sp., cf. P. acuta</i> Muschler, A.	42
<i>P. laxiflorus</i> Benth.	14, 22, 84, 85	<i>P. adenopoda</i> Harv.	60, 68, 69
<i>P. madagascariensis</i> (Pers.) Benth.	19, 54, 57	<i>P. divaricata</i> Less.	64, 66, 74, 75, 76, 82
<i>Pleiospilos prismaticus</i> (Marl.) Schwart.	71	<i>P. erythrochaeta</i> DC.	63, 64, 69
<i>Pleurostylia capensis</i> (Turcz.) Oliv.	54, 84	<i>P. fasciculata</i> L.f.	62
<i>Plinthus karooicus</i> Verdoorn, G	43, 63, 64, 67, 69, 73	<i>P. flexicaulis</i> L.f.	62
<i>P. sericeus</i> Pax	39	<i>P. glauca</i> Thunb.	63, 64, 66, 68, 71, 72, 73, 81
<i>Plumbago auriculata</i> Lam.	18, 51, 53, 55, 56, 57	<i>P. glaucescens</i> DC.	63
<i>Poa binata</i> Nees, G	82, 95, 101	<i>P. glomerata</i> L.f.	42, 43, 60, 63, 64, 66, 67
<i>Podalyria</i>	105	<i>P. heterocarpa</i> DC.	70
<i>Podocarpus</i>	3, 20, 84, 85, 105	<i>P. incana</i> (Burm.) DC.	51, 55, 59, 62, 64, 66, 74, 81, 82, 86
<i>P. falcatus</i> (Thunb.) R. Br. ex Mirb.	19, 21, 22, 25, 82, 84, 85	<i>P. inflexa</i> Thunb. ex L.f.	66, 68, 70
<i>P. henkelii</i> Stapf	22, 84, 85	<i>P. intermedia</i> Phill. & Hutch.	71
<i>P. latifolius</i> (Thunb.) R. Br. ex Mirb.	13, 19, 20, 21, 22, 26, 82, 84, 85, 101	<i>P. leptospernoidea</i> DC.	74
<i>Pogonarthria squarrosa</i> (Licht. ex Roem. & Schult.) Pilg., B	28, 29, 31, 39, 40, 47, 49, 50, 90, 99, 103	<i>P. leucoclada</i> Turcz.	67, 68
<i>Polemannia grossulariaefolia</i> Eckl. & Zeyh.	97	<i>P. mucronata</i> DC.	67, 68, 69, 73, 77
<i>Pollicia campestris</i> Ait.	29, 37, 40	<i>P. onobromoides</i> DC.	75
<i>Polypoda</i>	105	<i>P. ovalifolia</i> DC.	75
<i>Polycorena cuneifolia</i> (Benth.) Levyns	17	<i>P. pallens</i> L.f.	62
<i>Polygona</i>	105	<i>P. paniculata</i> Thunb.	62
<i>P. affinis</i> DC.	86	<i>P. sordida</i> N.E.Br.	64
<i>P. asbestina</i> Burch.	73	<i>P. sp., cf. P. glabratula</i> L.f.	70
<i>P. fruticosa</i> Berg.	86	<i>P. sp. (Kambrabos)</i>	70, 74
<i>P. garcinii</i> DC.	86	<i>P. teretifolia</i> (Thunb.) Fourc.	25
<i>P. hirtentota</i> Presl	23	<i>P. tricephala</i> DC., B	81
<i>P. myrtifolia</i> L.	59, 62, 75, 81	<i>P. undulata</i> DC.	74
<i>P. ohlendorffiana</i> Eckl. & Zeyh.	82, 84	<i>P. unguiculata</i> S. Moore	72, 73
<i>P. pungens</i> Burch.	69	<i>Pterothrix spinescens</i> DC., B	64
<i>P. semiundata</i> Harv.	60, 67, 68	<i>Ptychosilium biflorum</i> (E. Mey.) Brummitt subsp.	73
<i>P. sphenoptera</i> Fresen.	30	<i>Pupalia atropurpurea</i> Moq.	17
<i>Polyodium polypodioides</i> (L.) Hitchc.	22, 84	<i>Putterlickia pyracantha</i> (L.) Szyszyl.	18, 42, 54, 55, 56, 59, 61, 72, 74, 75, 86
<i>Polystichum luctuosum</i> Moore	22, 26, 82, 84, 85	<i>P. verrucosa</i> (E. Mey. ex Sond.) Szyszyl.	17
<i>Portulacaria</i>	58	<i>Pygeum africanum</i> Hook. f. & Kalkm.	23, 26
<i>P. afra</i> Jacq.	4, 23, 53, 55, 56, 57, 58, 60	<i>Pygmaeothamnus zeyheri</i> (Sond.) Robyns	99
<i>Pouzolzia hypoleuca</i> Wedd.	32	<i>Pyrenacantha scandens</i> Planch.	17
<i>Premna moorensis</i> (Pears.) Pieper	24, 30	<i>Radyera urens</i> (L.f.) Bullock	60, 67, 69
<i>Prenia pallens</i> (Ait.) N.E.Br.	70	<i>Rapanea</i>	23
<i>Prismatocarpus</i>	105	<i>R. melanophloeos</i> (L.) Mez	13, 18, 19, 21, 24, 26, 82, 84, 85, 102
<i>Prosphytochloa prehensilis</i> (Nees) Schweick.	14, 19, 22, 85	<i>Rauvolfia caffra</i> Sond.	4, 19, 23, 24, 27, 29, 50
<i>Protea</i>	3, 4, 27, 46, 105	<i>Relhania genistaefolia</i> (L.) L'Hérit., B	62, 81, 86
<i>P. caffra</i> Meisn.	20, 49, 50, 99	<i>R. pungens</i> L'Hérit.	20, 97
( <i>P. hirta</i> Klotzsch) subsp. <i>glabrescens</i> Beard = <i>P. welwitschii</i> Engl. subsp. <i>glabrescens</i> (Beard) Beard	99	<i>R. squarrosa</i> L'Hérit., B	62, 81, 86
<i>P. lacistema</i> Salisb.	84	<i>Rendlia altera</i> (Rendle) Chiov.	27, 83, 86, 95, 96, 101
<i>P. multiflora</i> Phill.	20, 83	<i>Restio</i>	17, 20, 98, 107
<i>P. ruppelliae</i> Meisn.	20, 27, 83, 101		
<i>Protorhus</i>	20, 21		

<i>R. sieberi</i> Kunth. var. <i>schoenoides</i>	101
Pillans	
<i>R. triticeus</i> Rottb.	25
Restionaceae	105
<i>Rhamnus prinoides</i> L'Hérit.	18, 26, 63, 82, 84, 95, 97, 101, 103
<i>Rhigozum</i>	4, 33, 34, 73
<i>R. brevispinosum</i> Kuntze	32
<i>R. obovatum</i> Burch.	32, 41, 42, 43, 55, 58, 60, 61, 69, 72, 73
<i>R. sp. cf. R. obovatum</i> Burch.	34
<i>R. trichotomum</i> Burch.	40, 41, 42, 63, 66, 67, 68, 72, 73, 74, 75, 79
<i>Rhinephyllum luteum</i> (L. Bol.) L. Bol.	61, 71
<i>R. macradenium</i> (L. Bol.) L. Bol.	61, 70, 71
<i>Rhipsalis</i>	3
<i>Rhizophora mucronata</i> Lam.	17
<i>Rhoiacarpos capensis</i> (Harv.) A. DC.	18, 54, 56
<i>Rhoicissus</i>	50
<i>R. digitata</i> (L.f.) Gilg & Brandt	17, 81, 53, 54, 55, 56, 57, 59, 84
<i>R. rhomboidea</i> (E. Mey. ex Harv.) Planch.	14, 19, 22, 26, 85
<i>R. tormentosa</i> (Lam.) Wild & Drumm.	14, 16, 18, 19, 26, 85
<i>R. tridentata</i> (L.f.) Wild & Drumm.	14, 17, 18, 19, 24, 26, 32, 53, 54, 82, 84, 95, 103
<i>Rhus</i>	32, 36, 41
<i>R. chirindensis</i> Bak. f. <i>forma legitati</i> (Schonl.) R. & A. Fernandes	13, 19, 21, 26, 84, 85
<i>R. ciliata</i> Licht. and forma	41, 42, 43
<i>R. crenata</i> Thunb.	17, 87
<i>R. dentata</i> Thunb. var. <i>grandifolia</i>	95, 103
<i>R. discolor</i> E. Mey.	20
<i>R. divaricata</i> Eckl. & Zeyh.	95
<i>R. dregeana</i> Sond.	41, 42, 72
<i>R. dura</i> Schonl.	101
<i>R. erosa</i> Thunb.	7, 63, 78, 95, 97
<i>R. glauca</i> Thunb.	75, 86, 87
<i>R. guenzii</i> Sond.	17, 32, 46, 48, 49
<i>R. horrida</i> Eckl. & Zeyh.	74
<i>R. incisa</i> L.f.	18, 59
<i>R. laevigata</i> L.	75, 87
<i>R. lancea</i> L.f.	36, 41, 42, 60, 63, 69, 71, 72, 90
<i>R. longispina</i> Eckl. & Zeyh.	18, 51, 54, 56, 58, 86
<i>R. lucida</i> L.	18, 19, 20, 58, 59, 62, 63, 86, 87, 97
<i>R. macowanii</i> Schonl.	95
<i>R. pentheri</i> Zahlbr.	52, 103
<i>R. populifolia</i> E. Mey. ex Sond.	75
<i>R. pyroides</i> Burch.	41, 43, 63, 101
<i>R. refracta</i> Eckl. & Zeyh.	18, 54, 55, 56
<i>R. rehmanniana</i> Engl.	103
<i>R. rosmarinifolia</i> Vahl	62
<i>R. sp., A. 13250</i>	17
<i>R. sp. = A. 14240</i>	74
<i>R. tomentosa</i> L.	87
<i>R. transvaalensis</i> Engl.	50, 82, 101
<i>R. undulata</i> Jacq. var. <i>undulata</i>	55, 58, 60, 61, 66, 74, 82
<i>R. undulata</i> Jacq. var. <i>tricrenata</i> (Engl.) R. Fernandes	41, 42, 60, 63, 72, 73, 90
<i>R. viminalis</i> Vahl	72
<i>R. zeyheri</i> Sond.	49
<i>Rhynchoselytrum repens</i> (Willd.) C.E. Hubb.	4, 24, 29, 42, 47, 48, 50, 59, 90,
<i>R. setifolium</i> (Stapf) Chiov.	24, 28, 50, 90, 99
<i>Rhynchosia adenodes</i> Eckl. & Zeyh.	23, 39
<i>R. caribaea</i> DC.	17
<i>R. confusa</i> Burtt Davy	40
<i>R. cyanospermum</i> Benth.	29
<i>R. densiflora</i> DC.	29
<i>R. totta</i> Thunb.	20, 23, 72, 84, 88, 94, 103
<i>Rhytidocarpus difformis</i> (L.) Benth. & Hook.	86
<i>Ricinus communis</i> L., P	23
<i>Rinorea angustifolia</i> (Thouars) Baill.	22
<i>Riocreuxia torulosa</i> Decne.	22
<i>Roella glomerata</i> A. DC.	20
<i>Rogeria longiflora</i> (Royen) J. Gay ex DC.	72
<i>Romulea</i>	105
<i>Rosenia glandulosa</i> Thunb.	63
<i>Rothmannia capensis</i> Thunb.	19, 22
<i>R. globosa</i> (Hochst.) Keay	19, 22
<i>Rubia cordifolia</i> L.	17, 22
<i>R. petiolaris</i> DC.	103
<i>Rubus</i>	19, 26
<i>R. cuneifolius</i> Pursh., BB	85, 86
<i>R. ludwigii</i> Eckl. & Zeyh.	95
<i>R. pinnatus</i> Willd.	82
<i>R. rigidus</i> Sm.	14
<i>Ruellia</i>	37
<i>Ruschia</i>	59, 65, 75, 81, 98
<i>R. aculeata</i> (N.E.Br.) L. Bol.	62, 71
<i>R. bipinnata</i> L. Bol.	70, 75
<i>R. boliviensis</i> Schwant.	70
<i>R. cononotata</i> (L. Bol.) Schwant.	43
<i>R. caroli</i> (L. Bol.) Schwant.	61, 70, 74, 82
<i>R. comptonii</i> L. Bol.	70
<i>R. conjuncta</i> L. Bol.	70
<i>R. crassa</i> (L. Bol.) Schwant.	71
<i>R. cymosa</i> L. Bol.	62, 81
<i>R. decurvans</i> L. Bol.	70, 75
<i>R. ferrea</i> L. Bol., B.	61, 63, 64, 66, 67, 69, 71, 74, 77, 80
<i>R. fourcadei</i> L. Bol.	62
<i>R. frutescens</i> (L. Bol.) L. Bol.	70, 74
<i>R. fugitans</i> L. Bol.	65, 70
<i>R. hamata</i> (L. Bol.) Schwant.	86
<i>R. hutchinsonii</i> L. Bol.	70
<i>R. indurata</i> (L. Bol.) Schwant.	98
<i>R. kakamasensis</i> L. Bol.	73, 80
<i>R. langebaanensis</i> L. Bol.	70, 76
<i>R. laxipetala</i> L. Bol.	62
<i>R. leucantha</i> (L. Bol.) L. Bol.	67, 71, 80
<i>R. leucosperma</i> L. Bol.	65, 70, 80
<i>R. macowanii</i> (L. Bol.) Schwant.	75
<i>R. montagnensis</i> L. Bol.	62
<i>R. mucronifera</i> (Harv.) Schwant.	70
<i>R. multiflora</i> (Harv.) Schwant.	61, 62, 81
<i>R. muricata</i> L. Bol.	67, 69, 80
<i>R. parvifolia</i> L. Bol.	56
<i>R. pumila</i> L. Bol.	65
<i>R. variflora</i> L. Bol.	70
<i>R. robusta</i> L. Bol.	65, 70, 74, 79, 80
<i>R. sp., cf. R. kakamasensis</i> L. Bol.	65
<i>R. sp., A. 14461</i>	71
<i>R. sp., A. 15062</i>	80
<i>R. sp., cf. R. hamata</i> (L. Bol.) Schwant.	86
<i>R. stellata</i> L. Bol.	62
<i>R. testacea</i> L. Bol.	70
<i>R. tuberculosa</i> L. Bol.	64, 70
<i>R. uncinella</i> (Harv.) N.E.Br.	64, 69, 80
<i>R. utilis</i> (L. Bol.) L. Bol.	70, 74, 75, 76
<i>R. viridifolia</i> L. Bol.	70, 74
<i>Sacciolepis curvata</i> (L.) Chase	17
<i>Salacia gerrardii</i> Harv. ex Sprague	23
<i>S. kraussii</i> (Harv.) Harv.	17, 23
<i>Salix capensis</i> Thunb.	63, 72
<i>Salsola aphylla</i> L.f.	60, 65, 71
<i>S. glabrescens</i> Burt Davy	43, 64, 66, 68, 79
<i>S. humifusa</i> Brückner	79
<i>S. nigrescens</i> Verdoorn & C.A. Sm.	63, 64
<i>S. rabieana</i> Verdoorn & C.A. Sm., G	60, 63, 64, 68
<i>S. sp., cf. S. geminiflora</i> C.H.Wr.	60
<i>S. sp., A. 14455, 14184</i>	71
<i>S. spp.</i>	62, 70
<i>S. tuberculata</i> (Moq.) Schinz. subsp. <i>tuberculata</i> , G	63, 66, 67, 68, 69, 73, 77
<i>S. zeyheri</i> (Moq.) Schinz, B.	61, 64, 65, 67, 68, 70, 71
<i>Salvadora angustifolia</i> Turrill var. <i>australis</i> (Schweiz.) Verdoorn	30
<i>Salvia africana-lutea</i> L.	75, 76, 86
<i>S. clandestina</i> L. var. <i>angustifolia</i> Benth.	40, 43
<i>S. dentata</i> Ait.	74
<i>S. garipensis</i> E. Mey.	72
<i>S. namaensis</i> Schinz	42
<i>S. nivea</i> Thunb.	76
<i>S. radula</i> Benth.	43
<i>S. rugosa</i> Dryand. ex Ait.	64
<i>Sanicula elata</i> Buch.-Ham.	26, 84, 85
<i>Sansevieria</i>	18
<i>S. hyacinthoides</i> (L.) Druce	37
<i>S. sp., cf. S. zeylanica</i> Willd.	30
<i>S. thrysiflora</i> Thunb.	30, 54, 55, 57, 59
<i>Sapium ellipticum</i> (Hochst.) Pax	19, 23
<i>Sarcocaudon</i> <i>Pheriteria</i> DC.	70, 74
<i>S. patersonii</i> (DC.) Eckl. & Zeyh.	60, 66, 68, 71
<i>S. spinosum</i> (Burm. f.) O. Kuntze	70, 71
<i>Sarcostemma</i>	42
<i>S. viminale</i> R. Br.	4, 16, 18, 30, 37, 42, 53, 55, 56, 72, 74, 86
<i>Satyrium</i>	105
<i>Scabiosa columbaria</i> L.	24, 88, 95, 103
<i>Scaevola thunbergii</i> Eckl. & Zeyh.	17
<i>Scelletium</i>	62
<i>S. sp.</i>	63, 71
<i>Schefflera umbellifera</i> (Sond.) Baill.	13, 14, 16, 19, 20, 22, 23, 26, 85
<i>Schismus barbatus</i> (L.) Thell.	64, 70, 74, 76

- Schistostephium crataegifolium* (DC.) 24  
*Fenzl ex Harv.*  
*S. rotundifolium* (DC.) Fenzl ex 22, 26  
*Harv.*  
*Schizachyrium jeffreysii* (Hack.) 50  
*Stapf*  
*S. sanguineum* (Retz.) Alston .... 20, 24, 27, 42, 46, 49, 50,  
95, 99, 100, 101, 104  
*S. ursulus* Stapf ..... 100  
*Schizaea tenella* Kaulf. .... 20  
*Schizobasis intricata* Bak. .... 29, 60  
*Schmidtia kalthariensis* Stent .... 40, 67, 73, 75, 76  
*S. pappophoroides* Steud. .... 29, 30, 32, 34, 38, 39, 40,  
42, 44, 45, 46, 47, 48  
*Schoenoxiphium* ..... 20, 24  
*S. sparreteum* Kuk. .... 26, 82, 84  
*S. sp., A. 15990* ..... 98  
*Scleria* ..... 16, 58  
*S. afra* (L.) Thunb. var. *afra* ..... 18, 51, 53, 55, 56, 58, 61,  
73, 74, 80  
*S. brachypetala* Sond. .... 16, 27, 28, 30, 46, 49, 53  
*S. capitata* Bolle ..... 30, 38  
*S. latifolia* Jacq. .... 18, 23, 24, 51, 53, 55, 56,  
58  
*Scilla* ..... 29  
*S. nervosa* (Burm.) Jessop ..... 20, 89, 90  
*Scirpus* ..... 92  
*S. burkei* C.B.Cl. .... 88  
*Sclerocarya* ..... 28, 30, 44, 45, 104, 46,  
47, 48  
*S. caffra* Sond. .... 15, 23, 27, 28, 29, 30, 32,  
38, 44, 45, 46, 47, 48, 49  
*Sclerochiton harveyanus* Nees ..... 14  
*Scolopia flanaganii* Sim ..... 22, 82, 84  
*S. mundii* (Eckl. & Zeyh.) Warb. .... 22, 82, 84, 85, 100  
*S. zeyheri* (Nees) Harv. .... 16, 18, 19, 22, 26, 50, 53,  
84  
*Scutia myrtina* (Burm.f.) Kurz., B .. 3, 15, 16, 18, 26, 51, 53,  
54, 55, 56, 57, 82, 84, 85  
*Sebaea sedoides* Gilg var. *schoen-*  
*landii* (Schinz) Marais ..... 23  
*Secamone alpini* Schultes ..... 16, 18, 19, 26, 82, 84, 85  
*S. frutescens* Decne. .... 18, 53, 55, 84  
*Securinega virosa* (Roxb. ex Willd.)  
Baill. ..... 23  
*Seenannaria gerrardii* (Seemann) 22, 26  
Vig.  
*Selima* ..... 31  
*S. galpinii* Stent ..... 31, 32  
*Selaginella kraussiana* (Kunze) A. 22, 26, 84, 85  
Braun  
*Selago* ..... 3  
*S. albida* Choisy ..... 59, 81  
*S. brevifolia* Rolfe ..... 81  
*S. corymbosa* L., B ..... 24, 25, 50, 86  
*S. fruticosa* L., B ..... 86  
*S. minutissima* Choisy ..... 67  
*S. speciosa* Rolfe ..... 97  
*S. triquetra* L.f. .... 51, 57, 58, 104  
*Senecio* ..... 70, 85, 105  
*S. brachypodus* DC. .... 18, 53  
*S. bupleuroides* DC., B ..... 24  
*S. coronatus* (Thunb.) Harv. .... 94, 99, 100, 102  
*S. corymbiferus* DC. .... 74  
*S. cotyledonis* DC. .... 74  
*S. deltoideus* Less. .... 14, 17, 18, 26, 53, 82, 84,  
85  
*S. erubescens* Ait. .... 88, 94  
*S. inornatus* DC. .... 99  
*S. junccea* Harv. .... 59, 74  
*S. longiflorus* (DC.) Sch. Bip. .... 42, 72, 73  
*S. longifolius* L. .... 56, 57  
*S. macroglossus* DC. .... 18  
*S. mikanioides* Ott. .... 22, 82, 84  
*S. othonniformis* Fourc. .... 98  
*S. panduraefolius* Harv. .... 26  
*S. pleistocephalus* S. Moore ..... 37  
*S. pterophorus* DC., B ..... 17, 85  
*S. pubigerus* L., B ..... 86  
*S. pyramidatus* DC. .... 57  
*S. quinquelobus* DC. .... 26  
*S. radicans* (DC.) Sch. Bip. .... 55, 57  
*S. retrorsus* DC., P. .... 24, 25, 84, 85  
*S. rhynchosphaera* DC. .... 19  
*S. scleroides* Schweick., B ..... 102  
*S. serratuloides* DC. .... 15  
*S. sp., A. 14513* .... 75  
*S. sp., A. 12617* .... 64  
*S. sp. nr. *S. fulgens** (Hook.f.) 37  
Nichols  
*S. speciosus* Willd. .... 24  
*S. tamoides* DC. .... 82, 84, 85  
*S. venosus* Harv., B ..... 99  
*S. vitalis* N.E.Br. .... 55  
*Sericocoma avolans* Fenzl, G ..... 29, 60, 61, 72  
*S. pungens* Fenzl ..... 61  
*Sericorema remotiflora* (Hook.) 39, 40  
Lopr.  
*Serruria* ..... 105  
*Sesamothamnus lugardii* N.E.Br. .... 35, 38  
*Sesamum capense* Burm.f. .... 67  
*Sesbania mossambicensis* Klotzsch, B ..... 31  
*Setaria* ..... 3, 32, 33, 49  
*S. appendiculata* (Hack.) Stapf, G.. 73  
*S. chevalieri* Stapf ex Stapf & C.E. 14, 19, 22, 28, 29, 53, 54  
Hubb., G  
*S. flabellata* Stapf ..... 3, 39, 51, 88, 89, 90, 91,  
92, 94, 95, 99, 100, 103  
*S. lindenbergia* (Nees) Stapf ... 32, 50, 59  
*S. neglecta* de Wit, G ..... 36, 54, 55, 56, 58, 63  
*S. nigrirostris* (Nees) Dur. & Schinz 27, 57, 85, 86, 88, 89, 90,  
92, 95, 99, 100, 101, 103  
*S. perberbis* Stapf ex De Wit, G . 24  
*S. perennis* Hack. .... 24, 50  
*S. sphacelata* (Schumach.) Stapf & C.E. Hubb., G ..... 14, 17, 20, 23, 25, 28, 86,  
95  
*S. verticillata* (L.) Beauv., B ..... 64  
*S. woodii* Hack. .... 29, 31, 32, 36, 92  
*Sida triloba* Cav. ..... 54  
*Sideroxylon inerme* L. ..... 16, 18, 23, 24, 51, 53, 54,  
56, 75, 86, 87  
*Simocheilus* ..... 105  
*Sisymbidite sparteae* E. Mey. .... 70, 74, 75  
*Smilax kraussiana* Meisn. .... 14, 17, 26, 27  
*Solanum aculeastrum* Dun., B ..... 27, 82  
*S. aculeatissimum* Jacq. .... 19, 26  
*S. geniculatum* E. Mey. .... 17  
*S. guineense* L. .... 75  
*S. mauritianum* Scop., B ..... 19  
*S. supinum* Dun. .... 40  
*Sonchus dregeanus* DC. .... 23  
*S. nanus* Sond. ex Harv. .... 94  
*Sorghum versicolor* Anders. .... 31  
*Sparaxis* ..... 105  
*Sparmannia ricinocarpa* (Eckl. & Zeyh.) Kuntze ..... 82, 101  
*Spergularia media* (L.) Presl ..... 70  
*Sphaerostylis natalensis* (Sond.) 19  
Crozat  
*Sphalmanthus blandus* (L. Bol.) 61, 71  
L. Bol.  
*S. defoliatus* (Haw.) L. Bol. .... 61  
*S. delus* (L. Bol.) L. Bol. .... 70  
*S. framesii* (L. Bol.) L. Bol. .... 70  
*S. glanduliferus* (L. Bol.) L. Bol. .... 68, 71  
*S. rhodandrus* (L. Bol.) L. Bol. .... 65, 71  
*S. splendens* (L. Bol.) L. Bol. .... 71  
*S. suffusus* (L. Bol.) L. Bol. .... 80  
*S. tetragonos* (Thunb.) L. Bol. .... 60, 68, 71, 73, 79, 80  
*S. trichotomus* (Thunb.) L. Bol. .... 70  
*S. vigilans* (L. Bol.) L. Bol. .... 61  
*S. watermeyeri* (L. Bol.) L. Bol. .... 70  
*Sphenostylis angustifolia* Sond. .... 99  
*S. marginata* E. Mey. subsp. 16, 102  
*marginata*  
*Spirostachys africana* Sond. .... 15, 23, 30, 37, 47, 53  
*Sporobolus* ..... 5, 51  
*S. acutifolius* Stapf ..... 64  
*S. africanus* (Poir.) Robyns & Tournay ..... 17, 23, 24, 25, 27, 28, 84,  
86, 87, 103  
*S. centrifugus* Nees ..... 38, 85, 100  
*S. coronaudelianus* (Retz.) Kunth . 79  
*S. discosporus* Nees ..... 88, 89, 92, 104  
*S. festivus* Hochst. .... 32, 37  
*S. fimbriatus* Nees ..... 29, 36, 42, 43, 51, 53, 54,  
55, 56, 58, 59, 60, 63,  
64, 71, 73, 90, 91, 92,  
104  
*S. iocladius* Nees ..... 79, 91  
*S. lampranthus* Alg. .... 67  
*S. ludwigii* Hochst. .... 64, 71, 79, 81  
*S. nitens* Stent ..... 16, 35, 37, 48, 55, 56, 104  
*S. pectinatus* Hack. .... 50, 95, 96  
*S. lampranthus* Alg. .... 66  
*S. smuttsii* Stent ..... 53  
*S. sp., A. 13532* ..... 92  
*S. staphianus* Gand. .... 32, 49, 103  
*S. subtilis* Kunth ..... 19  
*S. tenellus* (Spreng.) Kunth, G ..... 79, 81, 92  
*S. virginicus* (L.) Kunth ..... 17, 86  
*Stachys* ..... 32  
*S. aethiopica* L. .... 14, 84, 98

<i>S. burchelliana</i> Launert	72	<i>T. macropoda</i> (E. Mey) Harv.	15, 17, 20, 23, 24, 102
<i>S. grandifolia</i> E. Mey. ex Benth.	26	<i>T. polystachya</i> E. Mey.	15
<i>S. multiflora</i> Benth.	74	<i>T. semiglabra</i> Sond.	29
<i>S. spathulata</i> Burch. ex Benth.	39, 43, 81, 90	<i>T. sphaerosperma</i> (DC.) Bak.	39
<i>Stangeria eriopus</i> (Kunze) Nash	14, 24	<i>Terminalia</i>	39, 44, 45, 46
<i>Stapelia</i>	4, 70, 74	<i>T. brachystemum</i> Welw. ex Hiern	45
<i>Stapelia flavopurpurea</i> Marl.	73	<i>T. phanerophlebia</i> Engl. & Diels	28
<i>Steganotaenia araliae</i> Hochst.	30	<i>T. prunioides</i> Laws.	30, 35, 38, 46
<i>Stenotaphrum secundatum</i> (Walt.) Kuntze	14, 17	<i>T. sericea</i> Burch. ex DC.	27, 28, 29, 33, 34, 35, 39, 44, 45, 46, 49
<i>Stephania abyssinica</i> Walp. var. <i>tomentella</i> (Oliv.) Diels	22	<i>Tetrachne</i>	90, 92, 97, 98
<i>Sterculus murex</i> Hemsl.	28	<i>T. dregei</i> Nees, GG	7, 78, 90, 91, 95, 96
<i>S. rogersii</i> N.E.Br.	30, 35, 36, 47	<i>Tetragonia</i>	71, 74
<i>Stilbe</i>	105	<i>T. arbuscula</i> Fenzl, G	63, 67, 68
<i>Stipa dregeana</i> Steud. var. <i>elongata</i> (Nees) Stapf	26, 57, 82, 84	<i>T. decumbens</i> Mill.	70
<i>S. tortilis</i> Desf.	70	<i>T. fruticosa</i> L.	60, 61
<i>Stipagrostis amabilis</i> (Schweick.) De Wint.	40	<i>T. spicata</i> L.f.	70, 75
<i>S. anomala</i> De Wint., G	60, 67, 68, 69	<i>Tetrauria</i>	24, 105
<i>S. brevifolia</i> (Nees) De Wint., GG	62, 66, 67, 75, 76	<i>T. cuspidata</i> C.B.Cl.	85
<i>S. ciliata</i> (Desf.) De Wint., GG	60, 62, 64, 66, 67, 68, 69, 71, 73, 75, 77	<i>T. sp. cf. T. macowanii</i> C.B.Cl.	98
<i>S. namaquensis</i> (Nees) De Wint.	40, 60, 62, 64, 68, 71	<i>Thannochopterus erectus</i> (Thunb.) Mast.	88
<i>S. obtusa</i> (Del.) Nees, G	43, 60, 62, 64, 65, 66, 67, 68, 69, 70, 71, 73, 75, 77, 78	<i>T. glaber</i> Pillans	25
<i>S. uniplumis</i> (Licht.) De Wint.	34, 35, 38, 39, 40, 41, 43, 44, 60, 90, 91	<i>Thamnosoma</i>	4
<i>S. zeyheri</i> (Nees) De Wint. subsp. <i>macropus</i> (Nees) De Wint.	17, 86	<i>T. africanum</i> Engl.	73
<i>Stoebe</i>	4, 105	<i>Themedia triandra</i> Forsk.	1, 3, 5, 8, 14, 16, 17, 20, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 36, 39, 40, 41, 42, 43, 44, 47, 48, 49, 50, 51, 52, 53, 54, 55, 58, 59, 60, 63, 78, 79, 80, 81, 83, 84, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 107
<i>S. vulgaris</i> Levyns, B	8, 20, 27, 84, 97, 99, 100	<i>Thesium costatum</i> A. W. Hill var. <i>juniperinum</i> A. W. Hill	103
<i>Stomatium peersii</i> L. Bol.	98	<i>T. hystris</i> A. W. Hill	43, 63, 81
<i>S. pyrororum</i> (Diels) L. Bol.	64	<i>T. lineatum</i> L.f.	60, 61, 72, 73, 74
<i>Strelitzia</i>	23, 24	<i>T. spinosum</i> L. f.	70, 75, 76
<i>S. caudata</i> R. A. Dyer	27	<i>Thunbergia atricarpifolia</i> E. Mey.	20, 23
<i>S. nicolai</i> Regel & Koern.	13, 14, 15, 16, 17, 19	<i>T. capensis</i> Retz.	24
<i>Streptocarpus rexii</i> (Hook.) Lindl.	22, 82, 84	<i>Titmannia</i>	105
<i>S. wendlandii</i> Spreng.	26	<i>Toddalia asiatica</i> (L.) Lam.	27
<i>Strophanthus gerrardii</i> Stapf	30	<i>Tolpis capensis</i> (L.) Sch. Bip.	95
<i>S. speciosus</i> (Ward & Harv.) Reber	22, 82, 84, 85	<i>Trachyandra aspera</i> Kunth var. <i>natagleucaensis</i> (Kuntze) Oberm.	89
<i>Struthiola argentea</i> Lehm.	25	<i>Trachyandra laxa</i> (N.E.Br.) Oberm. var. <i>rigida</i> (Suess.) Roessl.	39
<i>S. parvifolia</i> Bartl. ex Meisn.	25, 84	<i>Trachypogon</i>	86
<i>Strychnos</i>	36, 47	<i>T. spicatus</i> (L.f.) Kuntze	17, 20, 23, 24, 27, 28, 49, 50, 83, 85, 86, 87, 92, 94, 95, 96, 99, 100, 101, 102, 103, 104
<i>S. decussata</i> (Pappe) Verdoorn	18	<i>Tragus berteronianus</i> Schult.	79
<i>S. henningsii</i> Gilg	13	<i>T. koelerioides</i> Aschers.	39, 56, 60, 71, 81, 89, 90, 91, 104
<i>S. madagascariensis</i> Poir.	16, 28	<i>T. racemosus</i> (L.) All.	53, 60, 67, 69, 89
<i>S. pungens</i> Solered.	49	<i>Trema</i>	22
<i>S. spinosa</i> Lam.	16	<i>T. orientalis</i> (L.) Bl.	13, 19, 23, 26, 50, 85
<i>Stylosanthes fruticosa</i> (Retz.) Alston	29	<i>Trianthema triquetra</i> Willd. subsp. <i>parvipolia</i> (Sond.) Jeffrey	60, 68, 73
<i>Suaeda fruticosa</i> (L.) Forsk.	57, 60, 63, 71, 86	<i>Tribulus</i>	68
<i>Suregada africana</i> (Sond.) Kuntze	54, 72	<i>T. cristatus</i> Presl	73
<i>Sutera argentea</i> (L.f.) Hiern	72	<i>T. terrestris</i> L.	43, 60, 67, 72, 73, 75, 79
<i>S. atropurpurea</i> (Benth.) Hiern	43, 63, 69	<i>T. zeyheri</i> Sond.	72, 73, 75
<i>S. fruticosa</i> (Benth.) Hiern	70	<i>Tricalysia</i>	15
<i>S. grandiflora</i> (Galpin) Hiern	27, 28	<i>T. lanceolata</i> (Sond.) Burtt Davy	14, 19, 22, 24, 26, 50, 85
<i>S. halminifolia</i> (Benth.) Kuntze, G	63	<i>Trichilia emetica</i> Vahl	13, 14, 15, 16, 19, 20, 22, 23, 24, 26, 27
<i>S. macrosiphon</i> (Schltr.) Hiern, G	98	<i>Trichocladus critinus</i> Pers.	14
<i>S. maxii</i> Hiern	75	<i>T. ellipticus</i> Eckl. & Zeyh. ex Walp.	18, 22, 84
<i>S. pinnatifida</i> (Benth.) Kuntze, G	63, 74, 104	<i>T. grandiflorus</i> Oliv.	26, 27
<i>S. pristispala</i> Hiern	97	<i>Trichodesma africanum</i> (L.) Lehm.	72
<i>S. tristis</i> (L.f.) Hiern	60, 67	<i>Trichodiadema barbatum</i> (L.) Schwart.	60, 62
<i>Syzygium cordatum</i> Hochst.	13, 14, 15, 19, 22, 23, 24, 26, 27, 50, 100	<i>T. pomeridianum</i> L. Bol.	69
<i>S. gerrardii</i> (Harv. ex Hook. f.) Hochst.	19, 22, 23, 25, 27, 85	<i>Tricholaena capensis</i> Nees	73
<i>S. guineense</i> (Willd.) DC.	28	<i>T. monachne</i> (Trin.) Stapf & C.E. Hubb.	29, 38, 47
<i>Tabernaemontana ventricosa</i> Hochst. ex A. DC.	14	<i>Trichomeura grandiflunis</i> (Nees) Ekman	29, 39, 42, 47, 48, 49, 88, 90, 91, 99
<i>Tagetes minuta</i> L.	53	<i>Trichopteryx dregeana</i> Nees	27
<i>Talinum caffrum</i> (Thunb.) Eckl. & Zeyh.	29, 30, 72, 89	<i>Trimeria grandifolia</i> (Hochst.) Warb.	13, 19, 21, 23, 26, 82, 84, 85
<i>Tamarix</i>	4	<i>T. trinervis</i> Harv.	101, 103
<i>T. usneoides</i> E. Mey. ex Bunge	60, 69, 71, 72, 74	<i>Tripogon minimus</i> (A. Rich.) Hochst. ex Steud.	32
<i>Tapiphyllum parvifolium</i> (Sond.) Robyns	49, 101	<i>Triraphis andropogonoides</i> (Steud.) Phill.	28, 39, 49, 90, 92, 99, 104
<i>Tarchonanthus</i>	41, 42, 43	<i>T. fleckii</i> Hack.	73
<i>T. camphoratus</i> L. var. <i>camphoratus</i> , G.	16, 18, 32, 46, 75, 87, 90, 103		
<i>T. camphoratus</i> L. var. <i>litakunensis</i> (DC.) Harv.	39, 40, 41, 42, 43		
<i>T. galpinii</i> Hutch. & Phill.	23		
<i>T. minor</i> Less., G	41, 42, 58, 63, 72		
<i>Tarennia pavettoides</i> (Harv.) Sim	14		
<i>Tavaresia barklyi</i> (T.-Dyer) N.E.Br.	73		
<i>Teclea natalensis</i> (Sond.) Engl.	30		
<i>Tecomaria capensis</i> (Thunb.) Spach.	18, 19, 22, 30		
<i>Teedia lucida</i> Rud.	74		
<i>Tephrosia lupinifolia</i> (Burch.) DC.	39		

<i>T. ramosissima</i> Hack.	73	<i>V. rehmannii</i> Guerke	52
<i>Trisetum pumilum</i> (Desf.) Kunth	74	<i>V. zeyheri</i> Sond.	48
<i>Tristachya</i>	97, 103	<i>Wachendorfia</i>	105
<i>T. biseriata</i> Stapf	100	<i>Walafrida</i>	3
<i>T. hispida</i> (L.f.) K. Schum.	14, 16, 17, 20, 23, 24, 25, 27, 29, 49, 83, 84, 86, 87, 88, 92, 94, 95, 96, 99, 100, 101, 102, 103	<i>W. articulata</i> (Thunb.) Rolfe	64, 81
<i>T. rehmannii</i> Hack.	39, 95, 99, 100	<i>W. densiflora</i> Rolfe, B	89, 94, 99
<i>Tritonia</i>	105	<i>W. geniculata</i> Rolfe, G	64, 69
<i>T. securigera</i> Ker-Gawl.	57	<i>W. minuta</i> Rolfe	67
<i>T. sp., c.f. T. flava</i>	71	<i>W. saxatilis</i> Rolfe, B	78, 81, 89, 91, 97, 98, 104
<i>Triumfetta</i> <i>welwitschii</i> Mast. var. <i>hirsuta</i> (Sprague & Hutch.) Wild	102	<i>Waltleria indica</i> L.	29
<i>Trochomeria</i>	57	<i>Watsonia</i>	105
<i>Turraea floribunda</i> Hochst.	15, 23, 24	<i>W. densiflora</i> Bak.	20, 23
<i>T. obtusifolia</i> Hochst.	17	<i>W. meriana</i> Mill.	24
<i>Tylphora</i> sp.	26	<i>Wiborgia armata</i> Harv.	76
<i>Tylosena fassoglensis</i> (Schweinf.)	29	<i>W. obcordata</i> Thunb.	76
Torre & Hille.		<i>Widderingtonia</i>	84, 105
<i>Urelytrum</i> sp.	32	<i>W. nodiflora</i> (L.) Powrie	82, 97
<i>U. squarrosum</i> Hack.	50, 99, 100, 103	<i>Willdenowia striata</i> Thunb.	76, 87
<i>Urera tenax</i> N.E.Br.	23, 32	<i>Xeromphis rufus</i> (E.Mey. ex Harv.)	24, 52, 53
<i>Urginea pusilla</i> Bak.	81	Codd, B	
<i>U. sanguinea</i> Schinz	40	<i>Xerophyta retinervis</i> Bak.	99
<i>Urochlaena pusilla</i> Nees	70	<i>X. viscosa</i> Bak.	37
<i>Urochlaena</i>	35, 37, 48	<i>Ximenia</i>	38
<i>U. mosambicensis</i> (Hack.) Dandy	37	<i>X. americana</i> L.	30
<i>U. panicoides</i> Beauv.	53	<i>Xylotheca kraussiana</i> Hochst.	15
<i>U. pullulans</i> Stapf	29, 34, 53	<i>Xymalos monospora</i> (Harv.) Baill.	13, 19, 21, 22, 23, 26, 84, 85
<i>Ursinia</i>	105, 106	<i>Xyris anceps</i> Lam.	20
<i>U. montana</i> DC. subsp. <i>apiculata</i> (DC.) Prasser	98	<i>Zaluzianskya diandra</i> Diels	67
<i>U. nana</i> DC.	60, 67	<i>Zinnia peruviana</i> (L.) L.	53
<i>Urtica dioica</i> L.	98	<i>Ziziphus mucronata</i> Willd.	15, 16, 24, 28, 30, 31, 32, 34, 36, 39, 40, 41, 43, 46, 47, 48, 49, 52, 72, 73, 90, 103
<i>Uvaria caffra</i> E. Mey. ex Sond.	14, 15, 19, 22, 23, 26, 85	<i>Z. zeyherana</i> Sond., B	88, 99
<i>Vaccinium exul</i> H. Bol.	26	<i>Zornia milneana</i> Mohl.	23, 29, 99, 102, 103
<i>Vahlia capensis</i> Thunb.	81	<i>Zygophyllum debile</i> Cham. &	57
<i>Vangueria cyanescens</i> Robyns.	23	Schlechtd.	
<i>V. infusa</i> Burch.	23, 32, 49, 52, 53	<i>Z. dregeanum</i> Sond.	73
<i>Vanzylia annulata</i> (Berger) L. Bol.	70	<i>Z. flexuosum</i> Eckl. & Zeyh.	62, 69
<i>Vepris undulata</i> (Thunb.) Verdoorn & C.A. Sm.	13, 14, 16, 18, 19, 22, 54, 84, 85	<i>Z. foetidum</i> Schrad. & Wendl.	61, 63
<i>Vernonia angulifolia</i> DC.	17	<i>Z. giffillani</i> N.E.Br.	64, 67, 68, 69
<i>V. ampla</i> O. Hoffm.	26, 28	<i>Z. incrassatum</i> E. Mey., B	69
<i>V. mespilifolia</i> Less.	14	<i>Z. lichensteinianum</i> Cham. &	70
<i>V. natalensis</i> Sch. Bip.	23, 99, 101	Schlechtd.	
<i>V. oligocephala</i> (DC.) Sch. Bip. ex Walp.	88, 90, 92, 94, 99, 100	<i>Z. meyeri</i> Sond.	75
<i>Vigna nervosa</i> Markötter	23	<i>Z. microcarpum</i> Licht. ex Cham. &	43, 69
<i>V. unguiculata</i> (L.) Walp., s.l.	102	Schlechtd., B	
<i>Virgilia</i>	105	<i>Z. micropyllum</i> L.f.	60, 64, 66, 67, 68, 69, 71, 73, 77
<i>Viscum nervosum</i> Hochst. & A. Rich.	19	<i>Z. morgsana</i> L.	4, 57, 74, 75, 76, 77, 86, 87
<i>V. obscurum</i> Thunb.	18	<i>Z. retrofractum</i> Thunb.	65, 70, 71
<i>V. rotundifolium</i> L.f.	53, 54, 55, 56	<i>Z. simplex</i> L.	67, 68
<i>Vitellariopsis marginata</i> (N.E.Br.) Aubrev.	13	<i>Z. spinosum</i> L.	70, 76, 81
<i>Vitex harveyana</i> Pears.	28	<i>Z. staffii</i> Schinz	70
		<i>Z. suffruticosum</i> Schinz	72, 73



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MEMOIRS VAN DIE BOTANIESE OPNAME VAN SUID-AFRIKA

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